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PRINCIPLES OF SURGICAL PRACTICE

WOUND HEALING

MICHAEL L. MASON, M.D., F.A.C.S., Chicago, Illinois

DURING recent months a number of papers have been presented in the International Abstract of Surgery in the effort to stress fundamental problems of surgery. Particular reference is made to the papers of Reid and Stevenson on the "Treatment of Fresh Wounds," of Meleney on the "Management of Surgical Septicemia," of Koch on "The Cure of Infected Wounds," of Brown on the "Covering of Raw Surfaces," of Hartzell and Winfield on "Wound Disruption," and the reports of the noonday conferences at the 1938 New York Clinical Congress on "Wound Infection" presided over by Mont Reid, and on the "Treatment of Open Wounds" presided over by Roy D. McClure. These have all been directly concerned with important everyday problems of wound healing and wound infection.

The following paper is the final one of this group and sums up the entire problem, with perhaps a little greater stress on the historical background and on recent clinical and experimental investigations relating to the prevention of wound infection and the healing of wounds. If it may seem to readers that too little mention is made of the application of much of the most recent experimental work on the stimulation of healing by means of wound stimulants, and if the almost unconditional condemnation of antiseptics may seem unjustified in view of the recent studies of McClure and his co-workers, it is not because the writer does not appreciate their far-reaching possibilities. As McClure has stated, surgery must always advance and we cannot assume that no further progress is possible. It does not seem unlikely that some day a specific wound antiseptic will be developed which will be entirely or almost entirely harmless to tissues but destructive to germs. It is not at all unlikely that as the understanding of the intricate chemical processes of healing advances, wound stimulants capable of practical usage will be discovered. However, at the present time such antiseptic and stimulating substances are still in the experimental stage, and when they have been used clinically there has been some question as to the mode of their action. It is certain that even if such substances could be isolated, and if the chemical processes of healing could be favorably altered by therapeutic measures, the surgeon still could not ignore other fundamental principles of wound repair.

We offer no apology for what might seem to some readers undue emphasis upon subjects with which every surgeon is assumed to be familiar. Too often, in Reid's words, these subjects have served as "fillers for text-books" and have been passed by with only a nod of recognition by the busy student and interne hastening into the arena of practice. Some men would maintain that after all one must learn surgery by practicing it and cite the child who becomes proficient in speaking his mother tongue by constant use and constant contact with it. They would have to add, however, that if the child would become a master of his language he must spend many months and years in a study of grammar, of words and their meaning, of the fundamental

From the Department of Surgery, Northwestern University Medical School and Passavant Memorial Hospital, Chicago.

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background of his language, and so could he hope to lift himself to a higher plane of proficiency and achievement.

Unless the surgeon keeps asking himself, "How do wounds heal? How does nature combat infection? How can the surgeon aid in hastening these processes?" he is very likely to fall into that unthinking mechanical routine that makes progress impossible and gives him simply a number in the assembly line rather than a place on the directing staff.

The most ancient of the healing arts has been the care of injuries, and the earliest medical observations of man have concerned themselves with the healing of wounds. Even animals by instinct alone have learned something about the care of wounds. It is recorded that in its native state the monkey after a flight through trees and bushes cleans himself of thorns and twigs, and assists his neighbor in so doing—a service reduced largely to a search for parasites in the case of the monkey in captivity. Livingstone has noted that the wounded gorilla withdraws the spear from his body and dresses the wound with leaves to allay hemorrhage. Primitive man carried over with his evolutionary progression not only a keen interest in wounds but also methods of dealing with them. Fractured bones have come to us from the stone age and the satisfactory healing evidenced by many of them indicates that even before recorded history began man had learned to apply splints to keep the part at rest and to maintain apposition. We can logically assume that even before the time of the Egyptian papyri three of the principles of wound healing had been established: namely, the removal of foreign material, the control of hemorrhage, and the maintenance of rest. Many strange and fantastic conceptions of disease and treatment are recorded, but it is of interest to note how these three principles with increasing refinement appear, disappear, and reappear in surgical writings up to the present day.[1]

In the pre-Listerian days the surgeon was handicapped by a lack of knowledge of bacteria although he undoubtedly suspected their presence. Except for this fundamental lack, however, the ancient surgeons made many keen observations on the healing of wounds and recognized certain factors in the process which we would do well to re-emphasize today. The Talmud warns against touching wounds with the hands since the fingers cause inflammation. The ancient Hindus practiced wound closure with linen or bowstring sutures. The Greek surgeons emphasized the need for cleanliness in the operating room, and prescribed careful cleansing of the hands and nails and the wearing of clean clothing. Theodoric in the 13th century warned against the probing of wounds and taught the need for cleanliness. He maintained that wounds may be closed and that they would heal without suppuration if properly cared for, a phenomenon that was not seriously considered possible, except in rare isolated instances, until the late 19th century. Henry de Mondeville advised the washing of wounds to remove foreign matter and the avoidance of all things likely to cause pus. Larrey, surgeon to Napoleon, recognized the need for the immediate care of wounds and established the twenty-four-hour limit in the Napoleonic armies. He emphasized the necessity of rest and pointed out the harmful effects of too frequent changes of dressings—many of the wounded in the ill-fated Russian campaign were transported from Russia into France before their original dressings were removed. Diefenbach as early as 1850 advised wound excision so as to convert irregular crushed wound edges into clean regular ones which could be closed primarily. Pirogof went to great trouble to obtain clean water for the cleansing of wounds and by the introduction of the use of plaster-of-Paris in war surgery showed that he recognized the great value of rest in wound repair.

One further conception of wound healing emerges from the great mass of superstition and black magic of ancient and medieval medicine. It was early expressed by Celsus, who noted that the natural reactions of nature were often beneficial and that such a phenomenon as fever might be helpful in promoting cure. The idea that the tissues possess the power of healing in themselves may be inferred from the teachings of Theodoric, but it reaches its first unequivocal expression in the writings of Paracelsus. Out of his tremendous amount of confusing rhetorical and bombastic argumentative writings, some so obscure and mingled with alchemistic and mystical references as to be almost unintelligible, there develops a conception of the treatment of injuries entirely new and different from anything which had gone before. It can be expressed no better than in his own words: "For you should know that by their nature the tissues . . . contain within themselves an inborn balsam which heals wounds. . . . So should every surgeon know that it is not he but nature that heals wounds. . . . But that the surgeon should know in what manner he may serve to further nature's healing, let him protect the

[1]The advice of Homans, "try yourself to find your way back into the beginnings of anything in medicine," if followed, even imperfectly, adds greatly to the enjoyment of the study of any surgical problem.

wound from ever present external enemies, that they do not interfere with or poison nature's balsam, but that it may be allowed to work with all its natural forces under the surgeon's protection. . . . Under protection and rest and skillful dressings nature heals the wound edges together and makes the flesh grow. . . . For what makes flesh and blood and marrow?, not man, not food but nature which possesses in itself the power to grow and multiply. Food and drink only support this power; the rain and the earth do not make wood, only the tree itself can do so, but without rain and earth the tree dies." Paracelsus, however, did not busy himself greatly with operative surgery, although it is probable that he had experience in the handling of war wounds, and it remained for a more practical and less evangelistic surgeon, Paré, to recognize the validity of Paracelsus' teachings and bring them before the profession of his day. Paré's observation on the harmful effect of severe traumatizing agents was accidental, but his teachings of the value of bland dressings and his dictum, "I dressed him—God cured him," have come down to us as epochal contributions to surgery.

Samuel Gross in the middle of the 19th century expressed again the conception of wound healing and care which Paracelsus and Paré had so brilliantly defended. It remained, however, for Wm. S. Halsted to develop the rational care of wounds —accidental and operative—based upon a study of the process of repair. As Reid has stated, Halsted "tried at all times to evaluate and apply the various principles of wound healing in his work . . . every study or experiment . . . (was) invariably also made a problem of wound healing." His work has left as its greatest heritage an appreciation of the natural healing powers of the tissues and the necessity for not handicapping these powers with chemical or mechanical trauma, hemorrhage, foreign bodies, and infection.

The literature for the past twenty years is replete with reports of studies of wound healing and the exhaustive review by Arey published in 1936 deserves careful study by every surgeon. The gross and microscopic changes during wound repair are well known, and we also know many of the factors which influence them. The actual reparative stimuli, which appear to be protein in nature and are derived from leucocytes and other tissues, have been the subject of many studies and we know something about their nature. As to the actual nature of the healing process, however, how and why these growth-promoting substances act, we know very little. Healing appears to be a natural property of living organisms, which under certain optimal conditions proceeds at a definite and measurable pace. One cannot help but marvel at times at nature's tremendous powers of recovery despite apparently insurmountable obstacles. As examples of such reparative powers I should like to relate observations which Harvey S. Allen made during the course of some experiments with the healing of tendons. In a number of the dogs used for the experiment, a tube of catgut was slipped over the divided tendon, the tendon was sutured, and the tube was then slipped down over the site of the suture. In all of the experiments the tube behaved as a foreign body and led to a marked exudative reaction, and in many of the dogs the tendon failed to heal. In one instance, however, the tube was extruded from the wound and functional healing took place between the tendon ends. In another instance the tendon healed as a thin strand on the under surface of the tube which lay in a mass of gelatinous granulation tissue on the upper surface of the newly formed fibrous tendon.

The problem of wound disruption in abdominal surgery is entirely one of wound healing and has been the subject of considerable study. It was the topic of a symposium given by Meleney and Howes, Colp, Grace, White, and Heyd at the New York Surgical Society meeting, November 8, 1933. Several recent reviews, by Jenkins in Chicago, Fallis of the Henry Ford Hospital in Detroit, Glenn of New York, Singleton and Blocker of Galveston, and Hartzell and Winfield of Detroit, attest to the importance of wound disruption. These reviews however, more than anything else, serve to focus the surgeon's attention on the numerous factors of wound healing and to emphasize not only the major catastrophe of evisceration but other complications of healing which affect wounds and operative incisions on other parts of the body. While actual disruption occurs probably in from 1 to 2 per cent of abdominal incisions, wound disturbances of an equally serious nature as far as the wound is concerned, occur in a so much higher percentage of accidental wounds of the extremities that the occasional evisceration is a distinct rarity in comparison.

The factors which have to do with wound healing may be divided into those which act directly at the site of the injury and those which have an effect of a more general nature and act through the organism as a whole. It is not my purpose to maintain the theme that the local factors are more important than the general ones, although it has seemed to me that the disturbances in heal-

ing which we encounter clinically may be more often ascribed to a local disturbance than to some general pathological state or to the absence of healing power. Even in acute starvation healing proceeds as usual unless the starvation actually threatens life itself. The urge to heal is almost equal to the urge to live; nature will surmount all obstacles to close a wound. Before we can assume that the healing powers and stimuli to heal are absent or defective we must make certain that delayed healing is not due to impediments which we have put in the way. Nature works methodically; the removal of debris, dead tissue, blood clots, and invading bacteria must precede the actual repair. Certain it is that both the local and the general factors which may delay repair are quite largely under the surgeon's control.

Of the local factors which interfere with wound healing, infection has probably received too great an emphasis at the expense of other equally important ones. It is not my desire to minimize the epochal importance of the work of Pasteur and Lister; rather it is to emphasize the fact that the prevention of infection is not synonymous with the use of antiseptics. Whether or not infection will develop in a wound or operative incision will depend upon the nature of the contaminating micro-organisms and upon whether or not the soil within which they find themselves is favorable for growth. The development of infection will depend to a large extent upon those things which lead to disturbances of healing, so that we can look upon infection simply as a complication of healing. Whether or not infection will occur will depend in turn upon our success in ridding the wound of a sufficient number of bacteria and leaving the tissues in a condition able to combat successfully the bacteria that remain.

We may begin with the assumption that every wound, regardless of how it is made—operatively or accidentally—is contaminated. Meleney has shown that even in a well appointed operating room bacteria fall on a Petri dish at the rate of from 1 to 2 per minute, and similar studies made elsewhere have substantiated his findings. Ives and Hirschfeld have made cultures from clean operative wounds at various intervals from the time of skin incision to the time of closure and have found that positive cultures can be obtained from the subcutaneous tissues in practically 100 per cent. Even the peritoneum can be shown to be contaminated in almost 90 per cent. These wounds all healed by primary intention. Dimtza and Gutscher have been able to culture bacteria from approximately 80 per cent of accidental wounds. It is interesting that slightly more than half of the wounds which gave a positive culture before treatment healed by primary, while the remainder healed by secondary intention. In contrast, about three-fourths of the wounds which were found to have negative cultures previous to treatment healed without reaction, while about one-fourth healed by secondary intention. It is not at all improbable that with better methods of obtaining cultures all would have been found to have been contaminated.

The bacteria which contaminate a wound vary in virulence and pathogenicity, and in their ability to accommodate themselves to growth in the host. We can seldom predict just how readily a certain strain of bacteria will grow in a particular human host. For clinical purposes, however, we may divide the sources of wound contamination into two categories: contamination with bacteria from their natural habitats, and contamination with bacteria from human or analogous sources. To the first category belong such organisms as gain entrance to wounds at time of injury from an object not recently contaminated from human sources. To the second category belong those organisms which are transferred directly to the wound from a human host, from a culture, or from certain animals. To this category belong such sources of contamination as the human bite, animal bites, the tonsil snare, droplet infection, or the transference of organisms by means of contaminated fingers, instruments, or dressings.

This distinction between the two sources of wound contamination is important. It has been shown that the incubation period for bacterial growth in human tissues varies with the organisms and with the recentness with which they have been in contact with human hosts or appropriate culture media. When organisms gain entrance to tissues they do not at once begin to grow but lie dormant for some time until they become acclimated to their new environment. During this period of acclimatization or incubation they remain localized to the site of entrance and the wound is merely contaminated; if proper measures are taken the bacteria may be mechanically removed before infection occurs. After the period of incubation or acclimatization has passed growth occurs and the wound is infected; mechanical cleansing cannot then be accomplished; in fact, local surgical measures may be extremely dangerous.

Bacteria introduced into wounds at the time of the injury from dirt, dust and soil, from the

broken bottle, windshield, or window pane, or from the moving parts of machines and tools are rarely if ever accustomed to human tissue fluids. As Friedrich has stated, they are in that "vegetative condition in which organisms find themselves in the external world." Following their introduction into the tissues a period of adjustment (the period of contamination) occurs and we know pretty well how long this period lasts. The experiments of Friedrich published in 1898 have shown that if soil and dust are placed in the thigh muscles of guinea pigs, a period of from four to six hours elapses before the bacteria become invasive. If the contaminated muscle is excised within six hours all of the guinea pigs survive. If from six to eight hours elapse, 50 per cent of the animals succumb; while after eight hours elapse, all of the animals succumb to infection.

The last World War was the great clinical testing ground for Friedrich's experiments. The wound treatment which finally emerged from the war was immediate mechanical cleansing followed by closure (débridement and primary or delayed primary suture) within the first six to eight hours after injury. If the wounded were seen later than this—usually a maximum of eight hours was taken as the limit—the wounds were treated as infected.

The problem as to methods of removal of these organisms from wounds has been attacked from two viewpoints. First has been the attempt to destroy them with heat or chemicals. Boiling oil and the red hot iron[1] have passed into the shades of medieval surgery—almost; while chemical antiseptics as a more modern counterpart have still not reached that stage of perfection where they destroy bacteria without injuring also the delicate living cells upon which healing depends. It is my belief that, except for certain specific and limited indications, the patient with an open wound would be better off if we had no antiseptics at all and if we were compelled to rely on mechanical cleansing and washing. The false security given by a small bottle of colored antiseptic appears to compensate for the neglect of cleansing and salves our conscience with the feeling that by pouring a more or less painful substance into a wound we have done all we can to render it sterile. To see how far wrong such an assumption is we need only observe a group of wounds so treated. The tremendous amount of damage and harm to living tissues done with antiseptics is a credit to the drug salesman and a discredit to us. Any chemical agent capable of destroying organisms is also capable of destroying living cells.

The second method of removing bacteria from wounds has been that of mechanical cleansing, which Friedrich suggested on the basis of his experiments. He advised complete wound excision, provided the time limit of six hours was not exceeded. If this limit is passed the wound is no longer amenable to mechanical cleansing. Complete wound excision is not always possible nor is it necessary. Bacterial contaminants may be washed from wound surfaces in the same way that we wash our hands preparatory to an operation. This washing and cleansing with soap and sterile water is both efficient and feasible and can be depended upon to produce a surgically clean wound, provided the patient is seen and the cleansing accomplished within the first six hours after injury.

When we come to consider bacterial contamination from human sources, the situation is quite different. These organisms may be very virulent and are already more or less immune to the human antibodies or other immune substances. They may begin to grow within a very short period of time, they may become invasive almost at once, and attempts at mechanical removal are often of little avail. A virulent infection may develop within two or three hours. Wounds which are contaminated from sources of this type can seldom be seen sufficiently early to allow cleansing and must therefore be considered to be infected.

Unfortunately, organisms from human sources usually gain entrance into the wound *after* rather than *at* the time of injury. They may be introduced at the time of first aid by handkerchiefs or soiled dressings, eager fingers or unsterilized instruments used to stay a hemorrhage, or from droplet contamination from numerous bystanders. They may gain access to the wound during hasty examination without proper precautions in the emergency room, where masks and gloves are frequently forgotten. The horrifying evidence of these secondary infections in the days before Lister is a matter of historical record. Von Redwitz has noted that such infections (notably hospital gangrene, pyemia, tetanus, and erysipelas) ran like a pest through the hospital wards. Following 1,277 operations, the majority of which were amputations and reductions of open fractures, collected by von Redwitz from the records of leading European surgeons, there were 574 deaths, a mortality of 45 per cent, almost all due

[1] "We have seen many wounds so charred by the coagulator and the cautery knife that if they were traumatic wounds a careful effort to excise the dead tissue would be made," Reid and Stevenson.

to sepsis. Such gross contamination does not obtain today, but we still have secondary infection with us. This source of wound contamination we can in a large measure control; it is the source to which Holmes and Semmelweis called attention. It is the break in aseptic care which occurs between the time the patient is injured and the time he reaches the place where the wound is to be treated.

We can control this source of wound contamination by teaching proper first-aid care of wounds and by observing strict asepsis at all times during our care of wounds. The first-aid men should be taught that open wounds should be let alone, they should not be probed or investigated, nor should antiseptics be poured into them; they should be covered with a sterile dressing bandaged on snugly. Copious hemorrhage may be controlled with the pressure dressing or if necessary with a tourniquet. The part should then be put at rest on a splint or in a sling to prevent further damage and to allay pain during transportation, and the patient should be sent to the emergency room or office for care. Here strict asepsis should be observed. Examination for sensation and motion may often be accomplished without removal of the first-aid dressing. Examination of the wound should be restricted to simple inspection—no probing or digital exploration. Even during this inspection mouth and nose masking is advisable. Not until preparation for repair has been made and a proper aseptic "set-up" secured should the wound be exposed and treated. The open wound, regardless of the amount of apparent contamination, should be treated as a clean operative wound from the time of its inception until its proper aseptic closure. It is only by the observance of strict aseptic technique that we can avoid secondary contamination of the accidental wound.

Further reduction in the number of bacterial contaminants entering wounds at the time of operation is accomplished by the control of the air in the operating room. It is a curious thing that Lister's first application of Pasteur's discovery of bacteria was the attempt by means of a carbolic-acid spray to keep air-borne bacteria from the operative field. His efforts in this direction were largely misunderstood and the carbolic acid was poured into the wound where it or one of its modern counterparts is still poured today—to the detriment of clean healing. However within the past few years, largely because of researches made by Meleney, Hart, Truesdale, and others, efforts are being made to sterilize or at least materially reduce the bacterial content of operating-room air, with reduction in postoperative infection.[1]

The second factor which interferes with wound healing is the presence of dead or hopelessly devitalized tissues which favor bacterial growth and must be absorbed or extruded before repair can take place. Particularly dangerous are crushed and devitalized skin, fascia, and muscle, which are likely to occur in wringer, railroad, automobile, and punch-press injuries. Such damaged tissues should be removed by sharp dissection as one of the first steps of the operative care. This procedure must not be confused with wound excision which is done to remove contaminated tissue—the object here is the removal of tissue which cannot survive. Skin flaps which are separated from their base of vascular supply, lifeless avascular muscle, and shredded crushed fascia, in fact any tissue which will become necrotic, should be excised before the wound is closed. However, the original trauma is not always the only source of necrotic tissue, and it is illogical for the surgeon to spend much time in removing crushed skin and devitalized fascia only to leave in his wake more areas of similarly injured and devascularized tissues due to his own efforts. The necrosis and sublethal tissue damage following chemical antiseptics have been alluded to above. The promiscuous use of antiseptics in the open wound usually contraindicates extensive nerve and tendon repair which might otherwise have been possible. It is almost impossible to avoid mechanical injury to delicate living cells because of the very nature of the operative act, but this should be reduced to a minimum by gentle handling of the tissues, avoidance of rough retraction, careful sharp dissection in place of blunt dissection, the use of a knife in place of scissors, gentle sponging, and retraction of the tissues with hooks or retractors rather than grasping them with heavy hemostats with the resultant crushing of large masses of living matter.[2]

[1]Meleney's studies of infection in clean operative wounds have indicated the relative importance to be attached to various sources of wound contamination as they affect the aseptic operating technique. He has shown that few surgeons realize the high percentage of infections which follow even clean operations and has intimated that unless the sources are carefully studied and guarded against, the instances of such complications amount to from 10 to 15 per cent, many trivial it is true. After assurance that materials and supplies have been properly sterilized and are really germ-free, the sources of contamination to be especially guarded against in the order of their relative importance are the nose and throat of the entire operating room personnel, the hands of the surgeon and his assistants, the skin of the patient, and lastly the air of the operating room. "Lister believed that organisms dropping from the air played an important rôle in wound infection and developed his elaborate apparatus for spraying the atmosphere. It later developed that this was one of the relatively minor factors. However, with the other sources greatly reduced or eliminated, if nothing is done to minimize contamination from this source it becomes relatively important again." (Meleney. Surg. Gynec. & Obst., 1935, 60: 269.)

[2]The experimental and clinical work of Ellis, Magyary, Haubrisser, and others has shown that wounds produced by the electrosurgical units do not heal as quickly nor do they gain tensile strength as rapidly

Two other sources of devitalized tissue may be controlled by the surgeon during operation. The effect of exposure of the tissues to air and to the heat of the operating lights may be forgotten until at the end of a long operative procedure we find the fatty subcutaneous tissues and exposed nerves and tendons dry and shrunken. This may be prevented by keeping tissues moist at all times with salt solution. Bits of fat and other tissues (and incidentally bacteria) are left in the wound in the wake of any surgical procedure. These, if they remain in the wound, must be absorbed and in case of bacteria may lead to infection. It is therefore advantageous during operations for accidental injuries of the extremities, and with certain limitations in other instances, to wash the wound from time to time with a stream of normal salt solution.

The presence of blood and hematomas in the wound after closure leads to disturbances of healing. Careful hemostasis before closure and the use of a pressure dressing afterward tend to prevent the oozing which is almost certain to take place otherwise. In keeping with the indication to produce no further damage and to leave as little devitalized tissue as possible in the wound, the bleeding vessels should be carefully caught so as to avoid the grasping of large amounts of surrounding tissues since all structures distal to the ligature are destined to necrosis. Mass ligation and suture ligation for troublesome oozing or for bleeding which is difficult to control leaves behind in the aggregate a considerable amount of devitalized tissue which predisposes toward postoperative suppuration. As Reid has pointed out, we are somewhat in a dilemma with regard to hemostasis since each vessel caught and ligated adds to the aggregate of necrosis with which the wound must cope and also increases the total amount of foreign matter left within the wound. Gentle pressure during the operation will control a great deal of the minor bleeding and oozing and will diminish the number of ligatures necessary. The surgeon, however, should not sacrifice the ideal of a clean dry field; bleeding points which are not readily controlled by gentle pressure with a moist sponge should be ligated with fine silk. Postoperative oozing which is sure to occur from the surfaces of any wound and may lead to a serious accumulation of blood and serum in the tissues is easily controlled by the use of a pressure dressing after the skin has been closed. Large amounts of fluffed gauze may be bandaged snugly over a wound at the completion of the operation and when these dressings are removed from five to seven days later a clean, flat wound will be found.

The use of large amounts of foreign material both as ligatures and in the repair of divided tissues predisposes toward prolongation of the exudative phase, delays healing, and promotes infection. The suture is the most important of the foreign bodies which the surgeon introduces into a wound and in most instances the only one. It has been pointed out that the excellent results which Halsted obtained in his operative work were due to his great attention to careful gentle surgery, meticulous hemostasis, and the use of fine suture material. He chose silk, and there is today a tremendous swing among surgeons toward the use of silk in clean operative work of all sorts. Suture material causes foreign-body tissue reaction because of its size and quantity and because of its own chemical composition. Silk has shown itself much less irritant than catgut and may be used in much finer sizes. The work of Whipple has shown without doubt the superiority of its use in clean surgical work. The experiments of Howes on the strength of wounds sutured with catgut and with silk have shown that the exudative reaction lasts longer with catgut, and that the full strength of the wounds is gained somewhat earlier with silk than with catgut. Fewer complications follow the use of silk, as has been shown by Shambaugh's study; he found twice as many serious complications and nearly ten times as many minor ones after catgut, as after silk suture. This, however, does not tell the whole story since the use of silk usually requires a different technique of handling tissues than catgut. Silk is finer and the strands are more easily broken so that the surgeon must perforce be gentler in handling tissues, and there is less tendency to suture under tension. The knots of silk may be cut very short, since they do not swell and untie like those of catgut. Because of this factor alone less foreign material is left in the wound. There is, however, it seems to me, some misunderstanding about the type and sizes of silk which should be used and the manner of silk usage. Silk should be used in the fine grades, the finer the better, but since no two manufacturers use the same system of grading silk and since there is no standard it is not possible to

as similar wounds produced with a knife. The necrobiotic zone produced by the current must be dealt with before healing can take place. The disturbance in healing produced is most marked in the skin, less marked in the fat and muscle, while in the brain the wounds seem to heal almost as well as knife wounds. It seems obvious that the high-frequency units should be used only when they are indicated, e.g., in the removal of neoplasms, and in the control of numerous bleeding points, the tying of which would consume an inordinate amount of time or lead to excessive traumatization. Their indiscriminate use, however, to control bleeding which may well stop with pressure must lead to disturbances in healing.

state sizes definitely. As a general rule the surgeon who starts to use silk after using catgut tends to use the silk in sizes comparable to those of catgut. This is quite unnecessary even if we wish to have sutures of equal strength. As an imperfect gauge for silk size we may take the Corticelli sewing silk. Grade A in this particular brand is quite fine and we have found it to be useful for ligating small vessels, while Grade D is the heaviest necessary for any purpose. The heaviest silk used should not be as coarse as 0000 catgut, which is the finest obtainable. With reference to catgut in wound healing we must also recognize the work of Kraisl, Kesten, and Cimiotti on catgut sensitivity, and the experiments of Jenkins on rates of absorption of different types and brands of catgut. There is no doubt but that in some wounds catgut disappears very rapidly, apparently as a result of specific reaction of the tissues to it. On the other hand, Jenkins has shown that the rate of absorption is quite variable and does not correspond to the anticipated rate. The length of stay of catgut in a wound is uncertain and its premature absorption may lead to separation before healing is firm. Whatever the type of suture material used, it should be the finest in size that will hold the tissues in apposition. It should not have greater strength than the tissues sutured, since if tension gets too great the tissues will tear through. The softening and necrosis which occurs when tension develops in tightly drawn thick sutures soon renders the tissue incapable of holding any suture material.

It would seem that for clean operative wounds or for traumatic injuries properly and satisfactorily cleansed silk is an ideal suture. How far superior it is to very fine catgut used in the same fashion as silk we do not know since catgut in sizes comparable to silk is not available. However, catgut used as carefully as silk "with the silk technique" gives much cleaner healing than when it is used in heavy grades and large quantities as is so often the case. As Fallis has said, "It is evident that care in suturing is more important than the suture material used."

The significance of drainage as a possible source of disturbance in wound healing must not be overlooked. There is no doubt that the use of drains in clean traumatic wounds is seldom if ever indicated. If the wound is infected it should be treated as such with warm moist packs, rest, and fluids. If there is doubt as to the adequacy of the primary cleansing the wound may be left open, covered with gauze, and a delayed closure practiced in twenty-four hours. The introduction of wicks and tubes into clean wounds with the idea of leading out infection too often serves to lead it in. Following incisions for drainage of abscess cavities there seems to be no question but that some sort of easily removable drainage material is advantageous. However, it is only in very rare instances that drains should be left in place longer than from twenty-four to forty-eight hours. The daily removal and reintroduction of greasy wicks into incisions merely prolongs the healing and keeps up the exudative reaction. On numerous occasions we have seen a wound heal within a few days after the removal of a gauze plug which had been reinserted daily for a period of weeks.

I do not desire to enter into a discussion on the value or indications for drainage in the case of infections within the peritoneal cavity. There is certainly a marked tendency among surgeons today to avoid as much as possible the use of drainage here, and there is no question that if drainage can be omitted there are fewer complications and more rapid healing.

The leaving open of wounds is another source of wound contamination and delay in healing. The clean operative wound is, of course, always closed primarily and the vast majority of these wounds close by rapid primary repair. In the case of traumatic wounds, however, we still see some which have not been closed even though the time limit for primary suture has not been passed. Wounds are left open because the surgeon does not have confidence in his method of wound cleansing. The open wound, however, is almost certain to become infected, either from extraneous sources at the time of dressing or from the patient's own skin. The properly cleansed wound should be closed immediately by suture, or by skin graft if suture is impossible. It does not seem unlikely that the success of the tannic-acid treatment of burns is largely due to the good cleansing of the surface, to the pressure of the crust which minimizes exudation into the tissues and prevents fluid loss, and to the fact that the cleansed surface is sealed against bacterial invaders by an impervious crust. It has seemed to me that, besides the rest and immobilization which is afforded by the Orr treatment for osteomyelitis, the closure of the wound is also an important factor. In the case of raw surfaces resulting from deep burns and in other types of granulating wounds in which complete loss of skin precludes the possibility of rapid spontaneous repair, healing is promoted by early closure by means of skin grafts.

The suturing of skin or other tissues under tension is another factor which predisposes to delay

in healing. Particularly disastrous are tight skin sutures where a linear necrosis of the opposed edges may lead to a serious infection. In instances in which closure cannot be accomplished without tension the surgeon should have recourse to the various types of skin grafting in order to close the wound. The same constricting type of necrosis may occur in deeper tissues. Fascia, aponeurosis, and tendons if constricted by tight sutures also become necrotic and lead to disturbances in healing manifested by the development of phenomena which we recognize as infection. It is better that we think of such wound complications as disturbances in healing due to improper operative technique, rather than as infections *per se*.

The principle of rest for injured tissues while generally recognized is too often disregarded. We splint and immobilize the fractured bone or the sprained ankle, and as Billroth noted many years ago, often these severe injuries heal more quickly and more kindly, because they have been put at rest, than minor ones in which immobilization has been neglected. Splinting of the wounded part is nature's method of promoting healing. A visit to Sumner Koch's hand clinic at the Cook County Hospital, Chicago, shows the value which this surgeon puts on splinting and rest in the care of injured and infected hands. Regardless of the trivial appearing character of a wound, rest, usually best obtained by splinting, favors repair and in so doing discourages infection. Many times we see a sutured wound of the hand which has not been splinted or protected from injury become infected, and not infrequently this infection will subside if the hand is simply immobilized on a splint. It is, of course, obvious that the contaminating organisms are already present in the wound and that under favorable circumstances the cells can deal with them. If, however, the trauma of motion with its accompanying disturbance of healing and opening of avenues for invasion is added, the bacteria may be more than the tissues can cope with.

Healing tissues require an unimpeded blood supply because not only is proper nourishment necessary to the reparative process, but there is strong evidence that the stimulant to repair as well as antibodies for combating infection are products of or result from the break-down of white blood cells. The importance of good blood supply is exemplified in numerous instances which we can all draw from our experience. It is a common observation that wounds about the face heal very kindly and may even be sutured at the end of from twenty to twenty-four hours with a good chance of primary repair. Hansen has studied 1,000 injuries and classified them according to location and the nature of the healing. His criteria for primary healing were very strict; only wounds which were clean and dry and completely healed in seven days were considered to have healed by primary intention. Slight stitch abscesses or slight delay beyond seven days, as well as more extensive infections and disturbances were classed as secondary healing. In wounds of the head and neck primary healing was obtained in nearly 97 per cent if the care was given within twenty-four hours. For wounds of the upper extremity, 84 per cent healed per primam if cared for within six hours, 50 per cent if the six-hour limit was exceeded. Wounds of the fingers, including disarticulation, if cared for within six hours, showed primary healing in 80 per cent, if after six hours in 66 per cent. Wounds of the lower extremity treated within six hours showed primary healing in 74 per cent, after the elapse of six hours in 40 per cent. Local infiltration into tissues of which the blood supply is already poor may lead to gangrene, as Priestley has pointed out in the case of diabetes. Koch has stated that one of the factors which contraindicate local infiltration for drainage of infection is the disturbance of local circulation caused by the pressure of the anesthetizing fluids in the tissues. We cannot, of course, be dogmatic about the position in which injured parts be placed in order to favor good circulation. In general, slight elevation seems to be the most favorable position. Wangensteen at Minnesota has shown that even serious infection may be brought under control by simple immobilization and elevation in a plaster cast. However, it is conceivable that in some instances a seriously embarrassed circulation to a part may be assisted by having the part slightly below heart level. It does not seem at all unlikely that in the care of certain wounds the surgeon might profitably have recourse to some such measure as pavaex therapy, intermittent venous congestion, or the rocking bed to further healing in such parts as the lower extremities.

One procedure which it has seemed to me secures its beneficent effects by directly supporting the local circulation is the application of a pressure dressing over a wound following repair. Such a dressing prevents the postoperative oozing which is sure to occur after wound closure. It also acts to control the amount of local edema which in itself may be a factor in interference with the adequate blood supply. It also serves as a support to the local vessels and has proved especially valuable in the dressing of granulating wounds in which its effect has been compared by Koch to

that of the Unna boot and other forms of treatment for varicose veins. The pressure, however, must be applied with discretion. It must not be applied too tightly lest it shut off the blood supply, nor can it be applied too loosely when it has no effect. It must be resilient pressure, obtained by the use of large amounts of fluffed gauze or sea sponges. It should be applied evenly over a considerable area above and below the wound, but should not be so tight as to lead to edema peripheral to it. In case of granulating wounds in which skin grafts are to be applied the pressure is kept up until the granulations have become sufficiently clean to allow skin grafting. It is remarkable how frequently small granulating wounds epithelize under constant pressure.

Too frequent changing of dressings interferes with the immobilization of the part, disturbs the healing wound edges, and subjects the wound to possible secondary contamination. Unless some definite indication arises, the dressings placed on a wound at time of operation need not be disturbed until the sutures are to be removed. If we can wait this long we are often agreeably surprised by the kind way in which healing has taken place. The surgeon seldom gains anything by the inspection of a wound except the satisfaction of his curiosity. Of course, if symptoms of infection arise, if we fear subcutaneous hemorrhage has occurred, or if we are dealing with an already infected wound the situation is different. Changing of dressings has come to be almost a ritual, which satisfies the urge to do something for a wound. There is no more reason for changing dressings every day on a clean wound than there is for removing splints every day from a fracture. It is equally obvious that in the care of infected wounds, particularly in the early stages before localization, frequent changes of dressing and the disturbances which go with them are harmful. When drainage has been established daily dressings for the purpose of cleansing the area and removing the products of infection should be done under aseptic precautions and with gentleness.

The first five or six days following wound repair are the critical days. During this time, the lag period or exudative phase of wound repair, the stage is being set for the abrupt onset of fibroplasia. Necrotic tissue is being liquefied and removed, bacterial contaminants are being dealt with, and an increasing local resistance to bacterial invaders is developing. The tensile strength of the wound during this period depends almost entirely upon the sutures and the relaxation obtained by rest and splinting. Rest and avoidance of unnecessary manipulation are therefore particularly essential to proper healing during the exudative phase. That the wound is more susceptible to infection during this phase of wound healing and that for this reason alone dressings should be avoided for at least five or six days has been shown by the experiments of Du Mortier. Virulent staphylococcal cultures rubbed into sutured wounds led to infection with decreasing frequency and diminishing virulence up until the fifth postoperative day, after which they were unable to gain a foothold even in the holes left by removal of the sutures.[1]

There are a certain number of general factors which have a direct or indirect effect upon wound healing. Carrel has shown that healing of wounds occurs at a rate inversely proportionate to age and other investigators have confirmed this observation. We are all familiar with the delayed healing that may occur in the aged, but we all know also that healing does occur in the aged as well as the young and that often the diseased condition rather than age alone is the more important. Certain diseases such as diabetes and nephritis retard healing, but by what mechanism we are not always certain. Frequently the circulatory disorders which may be present are the most potent factor, since it is general experience that the diabetic may be subjected to operation as may the non-diabetic, provided the condition is of non-diabetic origin, and healing may be confidently expected by first intention. Acute and chronic anemia unquestionably may interfere with wound healing, through what mechanism we cannot be certain though we must think of hypoproteinemia and oxygen and nutritional want. Dehydration of even moderate degree has

[1]In Du Mortier's experiments incisions were made into the abdominal wall of guinea pigs and the wounds were sutured. The control wounds were simply covered with a sterile dressing and all healed by primary intention. Virulent cultures of staphylococci were rubbed into the experimental wounds at varying periods of time up until the seventh postoperative day. In instances in which the culture was rubbed into the wound immediately after operation every wound became infected and the infection was severe and often fatal. The same results were obtained when cultures were rubbed into wounds two hours after suture and six hours after suture. When twelve hours were allowed to elapse before the cultures were rubbed into the wounds 83 per cent of the animals became infected, but there was a noticeable diminution in the severity of the infection. After twenty-four hours but 66 per cent became infected, after two days 56 per cent, after three days 36 per cent, and at four days but 10 per cent, and along with the diminishing susceptibility to infection there was noted decreasing severity of those infections which did occur. Cultures rubbed into wounds on the fifth postoperative day, on the sixth day immediately after removal of the sutures, and on the seventh day uniformly failed to produce infection. Du Mortier justly concludes, "it is of clinical importance that for the first five days following an operative incision extreme care be taken in the manipulation of the wound as during this period infection is possible from implantation of virulent organisms on its surface." Parenthetically it is of interest to note that this period of 100 per cent susceptibility to infection corresponds to the time which Friedrich established during which mechanical removal of contaminants is possible. It is the pre-invasive phase of an infection during which there is no developed resistance to bacteria and in which they simply lie on tissue surfaces. As soon as invasion occurs, sometime between the sixth and eighth hour, tissue resistance to bacteria begins and becomes increasingly more effective as time goes on. Du Mortier has shown that this resistance to infection develops even if no organisms are present.

a marked inhibitory effect upon repair in general and experimentally has been shown to lead to striking weakness in healing wounds.[1] For optimal healing a good fluid balance should be maintained; salt and glucose and whole-blood transfusions will often lead to the healing of sluggish ulcers and infections, especially in children with granulating infected burn ulcers.

Distant infection is said to have a deleterious effect on wound healing and this statement is supported by Carrel's experimental work. How significant this factor is I cannot say. It is undoubtedly advisable to postpone elective operative procedures in patients with infections elsewhere. We are all familiar, however, with accessory drainage incisions which persist for weeks after the primary operative incision has closed, and it has been the experience of all of us with patients with multiple wounds to have all but one heal quickly by primary intention.

Two particular factors deserve special reference since they have been quite exhaustively studied and very definite clinical evidence supports critical experimental work. One of these is the effect of proteins on wound healing, which was first suggested by the experimental work of Carrel, later by more direct experiments of Clark, Harvey, *et al.*, and recently by Ravdin and his coworkers at Philadelphia. Carrel showed that the stimulus for wound healing was a protein, probably an embryonic type of protein, not present in all tissues but apparently occurring in white blood cells, tissue wandering cells, and connective tissues. Clark found delay in healing in animals fed on low protein diets. Harvey in experiments on guinea pigs showed that with high protein diets wound healing progressed about the same as with low protein diets. The latent period was the same; however, once fibroplastic proliferation started it proceeded more rapidly in animals on a high protein diet. Ravdin and his group at Philadelphia have made both experimental and clinical observations on blood proteins in wound healing. They have shown that with hypoproteinemia healing is retarded or may even cease and that when the protein is brought up to normal by the use of lyophile serum normal healing takes place.

Vitamin-C deficiency as a cause for disturbances of wound healing was suggested by Sokolov in a study of postoperative wound disruption. This surgeon found that wound disruption occurred with greater frequency during the late winter and early spring months and expressed the idea that this was due to Vitamin-C deficiency since the patients from whom the statistics were drawn were of the northern races whose Vitamin-C intake was much curtailed during winter. Experimental studies and clinical investigations have definitely borne out Sokolov's suggestion. Lanman and Ingalls observed a case of an infant with congenital atresia of the bowel in whom wound disruption followed operation. Studies of the tissue after death showed typical changes of scurvy. They have found that many infants show subnormal Vitamin-C blood content. Experiments on guinea pigs placed on diets low in Vitamin C showed that wounds in the scorbutic animals healed poorly, more slowly, and with the development of less tensile strength than in normal controls. Histological studies of the wounds revealed changes typical of scurvy, i.e., deficiency of collagen formation, the typical pathological picture as described by Wolbach. Taffel and Harvey have recently repeated the experiments and have found that in the scorbutic pigs there was definite delay in the development of normal tensile strength. Individuals with obstructive lesions of the gastro-intestinal tract who have been on deficiency diets because of various reasons (peptic ulcer, gastro-intestinal carcinoma, and other types of cachexias and food deficiencies) are the ones most frequently subject to wound disruption. Such patients, as has been shown by Youmans, will often show low Vitamin-C content in the blood even though there are no actual signs or symptoms of scurvy. In such patients efforts should be made before operation to see that blood ascorbic acid is brought up to normal levels.

Brief reference might be made to certain substances which are applied to infected wounds with the purpose of stimulating healing. I do not have reference to the use of antiseptics for the purpose of reducing the bacterial invaders. Experimental studies by Smelo and Anderson have shown that, except for the use of zinc peroxide in the control of micro-aerophilic streptococcal infection, the use of antiseptics as topical dressings seldom if ever reduced the bacterial flora and had absolutely no effect upon the rate of wound healing. However, following the suggestion that the natural stimulant to wound repair seems to be a protein, in which the sulfydryl radical is important, various substances containing this radical have been used with enthusiastic reports by the users. The use of maggots in the cleaning up of infected

[1]Bird and MacKay have studied experimentally the effect of dehydration on the tensile strength of wounds in the stomachs of rats on limited water intake. They have shown that during the early days of healing the wounds in the dehydrated animals are on the average weaker than in the controls and that throughout the entire experiment the total strength of the gastric walls in the dehydrated animals is less than that in the normal rats.

wounds containing necrotic tissue had been thought to be due largely to the fact that the maggots consumed the necrotic tissue. Robinson was able to show that the action of maggots was due partly at least to allantoin which was excreted into the wound, and that allantoin could be substituted for maggots. This observation has since been confirmed from many sides. Robinson subsequently found that urea, also excreted by the maggots, was efficacious in cleansing wounds of necrotic tissue and appeared to act as a growth stimulant. Numerous reports on the beneficial effects of urea on wound healing have appeared from this country and Europe and it seems not unlikely that there may be some merit in it.

The question of the effect of the local application of various vitamins upon wound healing has been subjected to clinical and experimental study, although as yet the results are not consistently in agreement. Loehr in 1934 reported that the local application of cod-liver oil on burns resulted in more rapid healing, and subsequently cod-liver-oil dressings were applied to other types of wounds and injuries and have met with wide usage, especially in Germany. It was found that vitamin-free oils did not speed up healing and it was assumed that the vitamins, particularly certain essential fatty acids (Vitamin F), were the active agents, and it was believed that there was a synergistic action between Vitamin A and the fatty acids. However, workers in this country have not been able to substantiate the conclusions concerning the effect of cod-liver oil. Puestow, Poncher, and Hammatt from a recent study of burns treated with vitamin-containing ointments found a definitely increased rate of healing with such treatment but did not think that the vitamins could be held responsible for the action of cod-liver oil. A similar conclusion was reached by Getz in a study of healing of tuberculous ulcers in guinea pigs. While it appears that cod-liver oil contains some substance or substances beneficial to wound healing there is still no agreement as to the actual effective agent. Whatever may be the final conclusion regarding the efficacy of cod-liver oil on wounds, there is no doubt but that, as Burgass has pointed out, rest, protection from injury, and avoidance of frequent dressings must be important factors, and here may well be Loehr's most important contribution.

Many of the general factors in wound healing have been known since the time of Celsus, and while the conditions themselves are better understood and the modern surgeon with the aid of the laboratory and the internist can successfully combat most of them, we still do not know the exact mechanism of their interference with the healing of tissues. The diabetic may be safely subjected to operation, as may the non-diabetic. We have fairly accurate methods of determining Vitamin-C deficiency, though in this day and age of a vitamin-minded public it is questionable if this complication often arises. Should it arise, however, we have means at hand to remedy it. Except in emergency operations or operations upon seriously ill cachectic patients, the modern surgeon usually sees to it that the patient is in the best of general physical condition. It has seemed to me that it is the exceptional case in which the cause for the development of disturbances in healing, particularly infection, is to be sought in general rather than in local factors.

In résumé the factors which interfere with wound healing may be classified into those which act locally at the site of the wound and those which act in a more general way through the organism as a whole. The local factors which interfere with wound healing are infection (which is too frequently introduced secondarily or encouraged by disregard for the tissues), mechanical and chemical trauma; devitalized tissue, hematomas and hemorrhage, large amounts of foreign material, inadequate closure, suturing of tissues under tension, lack of immobilization, disturbances of circulation, and too frequent changes of dressing. The general factors that have been mentioned are anemia, diabetes, nephritis, hypoproteinemia, and the lack of Vitamin C. There are of course many others. However, it would seem that in the vast majority of instances the cause for disturbances of wound healing is to be sought in local or extrinsic factors over which the surgeon has control. Strict observance of the principles of aseptic and atraumatic surgery at all times in the handling of wounds, accidental or operative, must be practiced if we expect to obtain clean wound healing.

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

MacFee, W. F.: Malignant Tumors of the Salivary Glands. Report of 27 Cases. *Ann. Surg.*, 1939, 109: 534.

In the great majority of cases, malignant tumors of the salivary glands are epithelial in origin and are classified as carcinomas. They probably arise in displaced embryonal cells of the salivary glands or, more likely, from the buccal epiblast, with some underlying mesoblast.

Salivary-gland tumors, if derived from primitive embryonal tissues, may reasonably be expected to show a considerable diversity of structure, and this indeed is the case. A number of types are found in both the benign and malignant groups. The common types of malignant tumors are: (1) mixed tumors with malignant changes; (2) tumors composed of small cells of the basal type with either solid or cylindromatous arrangement; (3) papillary cystic tumors; (4) adenocarcinomas; (5) squamous-cell carcinomas; and (6) a somewhat heterogeneous group of tumors, usually rather undifferentiated, and not conforming to any of the preceding classifications.

The tumors behave, clinically, somewhat as their cellular structures would indicate. Metastatic lesions generally follow the pattern of the original tumor. In the case of the malignant mixed tumors, the secondary implants usually are found to appear in simpler form.

The tumors exhibit a wide variety of histological structure and of clinical behavior. They affect the sexes in nearly equal numbers and may occur at almost any age. The youngest patient in the present series was sixteen years old and the oldest sixty-eight years; the majority of the patients appeared to be in middle life. Some tumors apparently arise as malignancies, while others appear to be the result of malignant changes in primarily benign tumors. The disease may run a fatal course within a few months, or the patient may survive for many years with the disease. When metastasis occurs, the regional lymph nodes are occasionally involved, but not with great frequency. The incidence was approximately 15 per cent in the present series of 27 cases. Metastasis to the lungs is perhaps more common than is generally recognized. Eleven patients in this series had roentgenological examinations of the chest. Of these, 8 showed convincing evidence of pulmonary metastasis—an incidence of 72 per cent of those examined, and approximately 30 per cent of the entire series. A roentgenogram of the chest should be taken routinely in the study of these cases. The development of metastatic lesions does not appear to bear a close relationship to the duration of the disease. The tendency of malignant salivary-gland tumors toward remote metastasis, with relatively infrequent involvement of the regional lymph nodes, is in marked contrast to the behavior of other malignant epithelial tumors arising in the same general vicinity. Carcinoma of the tongue and buccal mucosa, for example, regularly metastasizes to the cervical lymph nodes and rarely extends beyond them.

The symptoms are few, and are by no means pathognomonic. A small nodule or swelling appears without apparent cause and increases in size, usually slowly, but sometimes rapidly. As a rule there is no pain; when pain is present, it is described as shooting or stabbing in character and is referred to the jaw, the side of the head, or to the ear. A large growth sometimes interferes with motion of the jaw. In advanced cases there is frequently a spontaneous facial paralysis due to nerve involvement. In appearance, the malignant tumor cannot be accurately distinguished from one which is benign. The palpation of more than one tumor mass is strongly suggestive of malignancy.

Other conditions which may be confused with tumors of the salivary glands are those affecting the groups of lymph nodes which are intimately associated with these glands. Branchiogenic tumors and cysts and tumors of the jaws, as well as various inflammatory conditions are also mistaken, now and then, for new growths of salivary-gland origin.

Histological differentiation of benign and malignant salivary-gland tumors is sometimes extremely difficult. A malignant tumor may appear encapsulated and be indistinguishable microscopically from a benign growth. The diagnosis in such cases depends ultimately upon the clinical course of the disease. In the average case of salivary gland tumors, the histological diagnosis is made with relative certainty.

Treatment of the malignant tumors is far from satisfactory. Radical surgery frequently carries the handicap of producing facial-nerve paralysis when applied to parotid tumors, and this occurs in the great majority of cases. In many instances it also fails to eradicate the tumor completely. Radiation has the disadvantage of threatening the integrity of normal tissues, especially the skin, if given in dosage sufficient to destroy the tumor. The principal complications of radiotherapy are the occasional radiation necrosis, atrophic changes in the skin and deeper tissues, with postradiation dermatitis or ulcer, and

atrophy of the salivary and mucous glands with consequent dryness of the mouth. Heavy radiation is also sometimes followed by facial paralysis. A combination of surgery and radiation appears to have given better results than either of these methods used alone.

The result in a given case cannot be predicted with any great accuracy. The general prognosis can scarcely anticipate the ultimate cure, or five-year survival, of more than 25 per cent.

JOSEPH K. NARAT, M.D.

Lacy, N. E., and Engel, L. P.: Acute Osteomyelitis of the Superior Maxilla in Children: Report of a Case. *Arch. Otolaryngol.*, 1939, 29: 417.

Acute osteomyelitis of the superior maxilla is an unusual disease, but it presents a rather typical appearance in infants. While a gastric disturbance may be the first sign of impending trouble, the first indication of the location of the disease is the edema and swelling of the eyelid, without involvement of the conjunctiva or lacrimal sac. Swelling of the periorbital tissue may be great enough to cause marked exophthalmos. There are redness, swelling, pain, and tenderness over the cheek of the infected side. The inflammation goes on to suppuration, and rupture occurs usually below the inner canthus, at which site a discharging fistula remains. Marked swelling and redness over one-half of the hard palate are equally common. Localization also occurs in the alveolar process of buccal fold in the region of the canine fossa.

Early spontaneous rupture or operative procedures establish drainage of the infected bone and result in discharging fistulas. These multiple sinuses show a characteristic discharge of purulent material containing small particles of bone or sequestra and sometimes unerupted teeth. The fistulas are easily probed. As a rule, there is a thick purulent discharge from the nose, although this finding has not been described in some of the reports of other observers. The temperature is most often irregular; anorexia may be noted, and there is difficulty in feeding because of the soreness of the mouth, the swelling of the sucking pad, and the presence of pus in the nasopharynx and nose. The outcome of the disease may be complete healing, healing with persistent sinus formation, development of secondary foci, or death.

Lacy and Engel believe that their case lends itself to the proof of the hematogenous origin of osteomyelitis of the superior maxilla. While the authors do not draw any definite conclusions, they indicate the advisability of early operative intervention. Drainage should be established primarily through the mouth and secondarily through the antrum of Highmore. Whenever possible, drainage through the skin of the cheek overlying the superior maxilla should be avoided, even though a fistula should be present. Finally, maxillary sinusitis is a complication of the osteomyelitis rather than a cause of it.

NOAH D. FABRICANT, M.D.

EYE

Leech, V. M., and Sugar, H. S.: The Reduction of Postoperative Complications in Cataract Operations with Corneoscleral Sutures. *Arch. Ophth.*, 1939, 21: 966.

In an effort to evaluate the place of the corneoscleral suture in cataract surgery an analysis was made of the cases operated on at the Illinois Eye and Ear Infirmary. These cases were divided into three groups: (1) those in which conjunctival flaps were used without sutures; (2) those in which there were conjunctival flaps with sutures, and (3) those in which corneoscleral sutures were employed. One hundred and fifty cases in each group were tabulated. The following table gives a summary of the comparative figures:

TABLE I.—COMPARISON OF COMPLICATIONS IN THE THREE GROUPS

	Prolapse of Iris and Vitreous; Incarceration of Iris	Hyphema	Anterior Chambers Not Reformed
Group 1...	12 cases (8.0%)	9 cases (6.0%)	11 cases (7.3%)
Group 2...	10 cases (6.6%)	17 cases (11.3%)	9 cases (6.0%)
Group 3...	6 cases (4.0%)	7 cases (4.6%)	4 cases (2.6%)

The authors believe that their statistics indicate the following advantages of the corneoscleral suture:

1. The number of postoperative prolapses are reduced, and if prolapse should occur it is smaller.
2. The occurrence of hyphema is reduced.
3. The anterior chambers are formed earlier.
4. Prolapse of the vitreous is eliminated.
5. If the vitreous is lost during the operation, the wound is closed securely after delivery of the lens and no further loss is feared.
6. When the ends of the suture are drawn taut, firm apposition of the surfaces of the wound is obtained even before tying, which allows irrigation to be done when indicated, and toilet of the wound to be completed in safety.
7. In cases in which patients cough, vomit, or become violent, the eyes are much more safe.

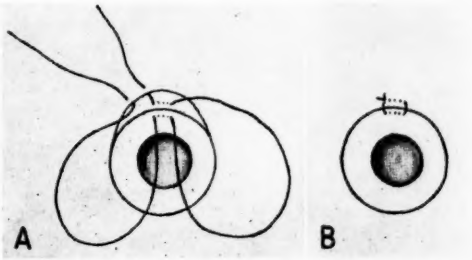

Fig. 1. A, suture in position, ready for corneal section. (The flap in this drawing is somewhat larger than is generally made.) B, appearance of suture at completion of operation.

8. Earlier and freer postoperative movement is permissible, a factor especially important in older patients.

9. It is especially advantageous for younger surgeons whose incisions may be less perfect.

Because of the small percentage of patients returning for refraction it was not possible to make an adequate comparison of visual acuities or postoperative astigmatism. No disadvantages from use of the method were seen. WILLIAM A. MANN, M.D.

EAR

Mill, W. A., Mollison, W. M., Watkyn-Thomas, Howarth, W., and Others: Discussion on Modern Surgery of the Labyrinth. *Proc. Roy. Soc. Med.*, Lond., 1939, 32: 831.

Mill states that at the present time surgery of the labyrinth is concerned with the treatment of labyrinthitis in its various forms, meningitis, Ménière's syndrome, and otosclerosis.

Ménière's syndrome involves recurring attacks of vertigo, perhaps associated with vomiting and falling; deafness, gradually increasing; and tinnitus. The indications for operation in this disease are: severe and often repeated vertigo, deafness of a high grade, and fixation of the stapes by osseous formation. A review of the various forms of operative intervention for this condition includes: opening of the external semicircular canal; opening of the canal and the placing of one end of a fine silkworm suture in it, while the other end is placed between the dura and the cranium; the injection of alcohol into the labyrinth; the use of diathermy to destroy the labyrinthine function; opening of the superior canal; division of the whole or a part of the eighth nerve; drainage of the saccus endolymphaticus; and rupture of the ductus endolymphaticus. Although Ménière's syndrome is being treated in a number of different ways at the present time, no individual procedure is completely satisfactory.

Mollison says that the various partial or complete labyrinthectomies are obsolete. These operations for acute and chronic labyrinth inflammations might be called for in rare cases of acute streptococcal invasion of the labyrinth, but in the future prontosil and continuous lumbar puncture may replace operation. There are cases in which suppuration around the internal ear results in sequestration of the whole labyrinth and then operation is performed to remove the whole labyrinth. Opening of the labyrinth is advised by some in certain cases of complications after fracture of the temporal bone. The attempt to restore hearing in otosclerosis has turned the attention of a number of surgeons to the semicircular canals. The external, posterior, and superior canals have been opened and the fistulas covered with various substances. Keeping the fistula open has been a great problem; it is desirable that a simple and certain method be found. Otology may then hope to live down its reputation for failure to do anything for deafness.

Watkyn-Thomas makes the following observations:

The only indication for translabyrinthine drainage was invasion of the meninges through the labyrinth, that is, a meningitis secondary to a suppurative labyrinthitis. The indications for labyrinthine intervention in otosclerosis were still very doubtful. The gravest suspicion was aroused by an operation on one ear which seemed to improve the hearing in the other ear which had not been operated upon.

Howarth says it was a question whether fenestration of the external canal along these lines had justified the claims made for it. Labyrinthine fenestration ought not to be done unless there is some promise of real improvement in economic hearing, that is, not just a slight improvement but something appreciable for ordinary conversation. There was some hope in an operation suggested by Sullivan of Toronto. The idea of his operation was to open the superior canal, allow the dura to fall down on the top of the window, and close it up in that way without gold leaf or anything of that kind.

Layton states that the bacteriology of otitic meningitis should always be specified. The infection was most frequently caused by the streptococcus hemolyticus, but the pneumococcus was sometimes found. The other group of cases of otitic meningitis was that with pre-existing active disease from organisms from the external auditory meatus.

According to Scott the historical review of this subject might include the names of Wallace, Marriage, Buzzard, West, Jansen, and Milligan.

Woodman observes that the operation on the labyrinth for acute sepsis was a trying procedure. The organisms lay in the greatest profusion at the point where the infection entered the dura.

Lambert says that certain neurological conditions, notably tumors of the cerebellopontine angle, are frequently diagnosed as Ménière's syndrome.

Hall makes the statement that the problem was not whether the otosclerosis operation was justifiable or could improve hearing, for that had been proved on many occasions, but how the improvement could be maintained, and that seemed to be a technical problem.

Negus says that if the problem were discussed with a plastic surgeon the opinion would be given that practically all operations so carried out were doomed to failure, unless an epithelial surface could be turned so as to face inward.

Tumarkin says that the stapes ought to be easy to extract together with the incus by means of a transmeatal atticotomy. The foramen ovale could then be covered either by a sliding flap, or a skin graft, and would be far less likely to stenose than any artificial opening that might be made into a semicircular canal.

The president of the discussion maintains that a labyrinthine operation should be performed if there were signs of labyrinthitis and the cerebrospinal fluid indicated the presence of meningitis.

NOAH D. FABRICANT, M.D.

NOSE AND SINUSES

Patterson, N.: External Operations on the Frontal and Ethmoidal Sinuses. *J. Laryngol. & Otol.*, 1939, 54: 235.

Patterson believes that operations on the nose should, when possible, be avoided. Extensive operations are frequently performed when there is no possible justification for them. In general, his observations refer to cases in which gross inflammatory or polypoid changes are present in the mucous membrane lining of the cavities concerned. These changes are frequently accompanied by the accumulation of purulent material.

It is often difficult to ascertain whether the disease is located mainly in the frontal or in the ethmoidal cells. Therefore the author regards it advisable during the period of investigation to view any case as one of fronto-ethmoidal disease. When a full exposure is made it is often discovered that both the frontal and ethmoidal cells are involved, although sometimes the disease is located solely in the ethmoid; it is extremely unlikely that the frontal sinus is affected alone. Not infrequently there is accompanying disease in the antrum and sometimes in the sphenoid sinus.

Even in very acute cases, there should as a rule be no undue haste in resorting to surgery. Pain which may be devastating, involvement of the soft parts over the frontal sinus, an external fistula, signs pointing to orbital or intracranial extension, general ill health as the result of septic absorption, the presence of nasal polypi associated with chronic ethmoidal suppuration, or the unsuccessful removal of the polypi by intranasal methods may point to the advisability of an external operation. An operation on the ethmoid may prove the key to the cure of a suppurating frontal sinus.

Every effort is made to eliminate as far as possible any subsequent scarring or deformity. There are only two regions where incisions are made: one in the neighborhood of the supra-orbital ridge, the other in the cheek. The "frontal" incision passes along the supra-orbital ridge and corresponds to the center of, or lies just below, the hairy eyebrow which should be cut but not shaved prior to the operation. The "ethmoid" incision begins about ¼ in. below the level of the inner canthus at the upper end of a sulcus or natural fold which can generally be seen passing outward and downward into the cheek. This incision is about an inch in length.

Through the frontal incision the frontonasal duct can be explored and the anterior ethmoidal cells opened up or removed. The question as to what kind of operation should be performed on the frontal sinus depends to a large extent on the severity of the disease, its duration, the condition of the lining membrane and bony walls, and the contents and size of the sinus. The nature and extent of the operation depends on anatomical and physiological conditions which cannot be fully ascertained till the diseased area has been exposed.

Fig. 1. Preliminary incision; the blade of the knife lies parallel to the skin so that the latter is cut obliquely. The upper and lower eyelids are temporarily approximated by sutures.

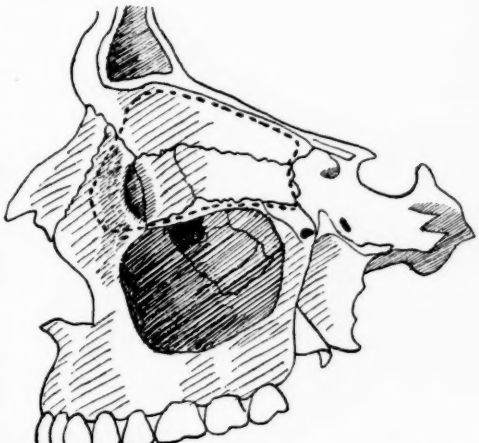

Fig. 2. Area enclosed by dotted line indicates the extent of the bone removed. In addition to the ethmoidal area it will be seen to include portions of the ascending process of the superior maxilla, the frontal bone, and nearly the whole of the lacrimal bone.

The ethmoid incision should be carried to the roof of the ethmoid, which is formed by the frontal bone and lies external to and is continuous with the lamina cribrosa. All mucous membrane is as far as possible removed from this plate. By the time the operation is finished no ethmoidal cells should be left unopened and all ethmoidal mucous membrane should have been removed. After this, the sphenoidal sinus should be inspected, and if diseased, a portion of its anterior wall removed.

NOAH D. FABRICANT, M.D.

MOUTH

Chance, O.: The Treatment of Buccal Carcinoma. *Irish J. M. Sc.*, 1939, 160: 145.

From 1930 to 1936, 539 cases of intra-oral cancer were examined by the author. The cancers were distributed as follows: tongue, 271; cheek, 43; alveolus, 54; palate, 48; floor of mouth, 75; and fauces, 48. Eighty-five and eight-tenths per cent of the patients were males, and 88.8 per cent were more than fifty years of age. In 237 patients (44 per cent) the cancer was hopelessly advanced, and in 312 (57.8 per cent) the glands were enlarged when first seen.

In most cases no sign of syphilis was detected. It appears that active anti-syphilitic treatment has an effect on intra-oral growths. They seem to become altered in character so that the exuberant type of malignant ulcer is replaced by an unhealthy thin-edged ulceration. Oral sepsis may play a rôle as a predisposing cause, but tobacco does not appear to be related to these growths. The average duration of symptoms was seven and one-half months, the longest twenty years, and the shortest one day.

The plan of treatment was to clear up oral sepsis as rapidly as possible by the use of mouth washes, extraction of teeth, and oral hygiene. Active treatment usually consisted of the implantation of radium needles or else the application of a radium-bearing dental splint. Radium applications were carefully planned and checked by special physical dosage charts. X-ray therapy was preferred for tumors of the base of the tongue and advanced or unusually bulky growths in other regions, particularly in the floor of the mouth. During the last few years occasional dramatic results were obtained in advanced cases complicated by large fixed cervical masses. The author believes that external radiation, either with x-rays or radium, will be used more and more frequently in the treatment of buccal cancer. A Chaoul contact x-ray plant was occasionally used for superficial growths accessibly placed. The author regards the treatment of the glandular fields as primarily a surgical problem.

Of 178 patients under treatment at least five years previous to this study, 18 were untraced, 7 died from unrelated causes, and 24 were well. Of 58 patients with tongue involvement who were treated radiologically, only 10 (17 per cent) were alive at the end of five years. Of 32 patients with small early lesions 8 (25 per cent) were alive at the end of five years.

The author pertinently remarks that one pound successfully spent on prevention or on an early diagnosis is worth thousands of pounds spent in elaborate medical apparatus.

MANUEL E. LICHTENSTEIN, M.D.

Engelstad, R. B.: The Treatment of Metastases in the Lymph Glands in Carcinoma of the Lips and Oral Cavity (Die Behandlung der Lymphdrusenmetastasen bei Lippen- und Mundhoehlenkrebs). *Nord. Med.*, 1939, p. 105.

During a three-year period, 135 patients with cancer of the mouth presented themselves for treatment at the Norske Radium Hospital at Oslo. Among this number were 72 with carcinoma of the tongue and 14 with carcinoma of the lips. Three to six years after the radium treatment 44 (32.6 per cent) with oral carcinomas remained free from symptoms, i.e., they were cured, whereas 85 patients had succumbed to the carcinoma. Of the patients with carcinoma of the lips 65.2 per cent had been healed. The successful cures were significantly dependent upon the absence of lymph-gland metastasis. In the absence of metastasis, 61.1 per cent of those with oral and 87.7 per cent of those with lip cancer were cured. In the presence of metastasis the successful cures amounted to only 17.4 and 48.2 per cent, respectively.

The treatment of lymph-gland metastases at first consisted of teleradium irradiation. When no success was obtained after eight weeks of such treatment, a total resection of the lymphatic-gland region was performed. The outcome following this form of treatment was considered good, as new metastases rarely occurred. However, in many of the cases treatment by teleradium irradiation alone led to a disappearance of the metastases.

(HAAGEN). HARRY A. SALZMANN, M.D.

NECK

Paschoud, H.: Hyperthyroidism and Kocher's Successor (L'hyperthyroidisme et le successeur de Kocher). *J. internal. de chir.*, 1939, 4: 185.

On the occasion of the retirement of Professor De Quervain from clinical teaching, the author presents a bird's eye view of what has been and is being done in the study of hyperthyroidism throughout the world. In Switzerland, and particularly in Berne, the endemic incidence of goiter compels a knowledge of hypofunction and hyperfunction of the thyroid as well as the problem of thyroid pathology as a whole, so that surgeons in these regions are privileged to gain a better insight into many aspects that puzzle workers in other lands. The investigations as to the nature and origin of the active thyroid substance are reviewed from Kocher's study on the iodine content of the thyroid gland from 1895 to the present, including the isolation of iodothyrine, and the demonstration of tyrosin and thyroglobulin. Twenty years later Kendall isolated crystalline thyroxin and after another ten years the synthesis of this substance was

accomplished. In 1933 it was discovered that the total iodine content of the thyroid gland was superior to that contained in thyroxin, and diiodotyrosin was isolated with only an insignificant effect as compared to thyroxin. Thus it was concluded that the thyroid hormone is made up probably of an iodized protein combination of thyroxin and diiodotyrosin. These findings were indispensable for the study of hypofunction and of great value in the study of hyperthyroidism.

As regards the regulatory system, the secretory rôle of the nervous system is still under discussion. As early as 1791 Schreger drew attention to the intermediary rôle of the thyroid in hindering too sudden and abundant a flow of blood to the brain. Recently Rein has offered evidence that would seem to support this theory.

At present the hormone regulation, by the thyrotrope hormone of the pituitary gland in particular, is receiving much attention with regard to a direct action upon the cells of the gland and an indirect action dependent upon the integrity of the diencephalon. Some writers believe that also the sex glands participate in the regulation of the thyroid system and recently sex hormones have been used in the treatment of hyperthyroidism. The effects of cold and diet on the function of the thyroid have been studied.

Important knowledge has been gained as to the site of action of the thyroid hormone. Thus certain effects of thyroxin are inhibited by the barbiturates which have a selective narcotic effect on the diencephalon. High section of the cord has a similar effect. The schools of Vienna and Budapest are of the opinion that the thyroid hormone can affect the metabolism, bio-energy, and blood cholesterine only when the diencephalon is functioning. As the thyroid also influences other endocrine glands this phase of the subject becomes extremely complex.

Prolonged administration of the thyrotrope hormone causes the appearance in the blood of an antagonistic substance which destroys the hormone effect, a so-called antithyrotropic hormone, the deficiency of which may lead to hyperthyroidism. In 1904 and 1905 De Quervain emphasized the toxic nature of the lesions of Basedow's disease. The studies on simple non-suppurative thyroiditis have thrown new light on the antitoxic rôle originally attributed to the thyroid.

A hasty survey is made of the many contributions of De Quervain, which comprised 69 articles and 1 book. Alcohol was found to have an effect on the thyroid gland very similar to that of Graves' disease. Toxic lesions were distinguished from hyperthyreosis. In 1912 and 1915 De Quervain published his monographs on the surgical treatment of goiter, recommending the ligature of the inferior thyroid arteries. Later experiments showed that the venous blood of the thyroid in Basedow's disease was more active than the venous blood of the normal thyroid.

In 1922 appeared the first clinical studies of the basal metabolism and its reactions to thyroidectomy, followed by investigations on the effect of iodine on the basal metabolism, and the value of iodine prophylaxis. In 1923, De Quervain contributed his book on goiter with a chapter on hyperthyroidism and a lucid exposé of his surgical technique. This was followed by studies of the blood picture in the various functional phases of the thyroid gland and by various contributions throwing light on the physiology and pathology of this organ. Among these may be mentioned the experiments on rats demonstrating increased sensibility to oxygen deficiency following the administration of blood from patients with Basedow's disease. The relation between true Basedow's disease and Basedow goiter was studied. Iodine Basedow's disease, although usually mild, may present most severe forms of hyperthyroidism. The clinical studies on basal metabolism by De Quervain and Pedotti extended to all forms of thyroid pathology. It was discovered that the basal metabolism was influenced much more by extensive resections than by rest cures and ligatures. As a working hypothesis he admitted the conception of dysthyroidism but could find no justification for changing the conception of hyperthyreosis as presented by Moebius and Kocher. At the International Goiter Conference in 1927 he disapproved of the indiscriminate use of organotherapy in cases in which careful examination would reveal no endocrine disturbance. He directed a statistical survey of Basedow's disease in Switzerland in an attempt to determine the rôle of iodine medication in the development of true Basedow's disease. He studied the effect of insulin shock in hyperthyroidism but found no reason for assuming a synergy between insulin and the thyroid hormone. In 1931, he published the results of his personal experiments on the oculocardiac reflex as affected by thyroid conditions, but concluded that the form of the reflex could not be used for differential diagnosis. The different results following iodine therapy of toxic adenoma and iodine Basedow's disease in America, as compared with results of such therapy in regions of endemic goiter, are stressed.

In 1932 De Quervain and Abelin contributed a section to the *Handbuch der biologischen Arbeitsmethoden*, in which an experimental study of the function of the thyroid was made by all available methods (including the acetonitrile test, the Reid-Hunt test, the glycogenic test, tadpole growth, phagocytosis, the colloidal chemistry of the blood, the Kottmann reaction, Starlinger's citrated blood test, basal metabolism tests, and studies of the blood vessels and the minute-volume in Basedow's disease), and in which the value of various thyroid preparations was presented. In 1932 De Quervain announced that the clinical symptoms of thyroid suppression were the result not only of deficient secretion but of antagonistic secretions.

At the second international Goiter Conference at Berne in 1933, Josselin-de Jongh separated the hyperthyreoses from true Basedow's disease. He did not feel that classification of the hyperthyreoses as toxic

adenoma was justifiable. Basedow goiter should be distinguished from hyperthyroid goiter because one has to deal with a diffuse parenchymatous goiter which may be filled to varying degrees with colloid. This colloid content is increased by iodine therapy. The lymphoid tissue is increased more in Basedow goiter than in hyperthyroid goiter. Josselin-de Jongh considers the hyperthyreoses as pure hyperfunctions in which iodine has an exacerbating effect, whereas in true Basedow's disease the function is incomplete and iodine may have a favorable if transitory effect. At this conference De Quervain reviewed the work of Josselin-de Jongh, Eppinger, and Sturm. He stated that in ten years he had seen personally 33 cases in which iodine treatment had led to the development of more or less severe Basedow's disease.

In 1936 De Quervain compiled a history of iodine in the physiology and pathology of the thyroid gland. According to De Quervain iodine Basedow's disease is almost a classic Basedow's disease, with slight or no exophthalmos, but in which the gland does not always present the symptoms of hyperfunction in spite of the clinical evidence. In his opinion iodine, by permitting the maintenance of morphological and functional integrity of the thyroid, in spite of the presence of goiter, exerts a physiological, prophylactic, and often therapeutic effect.

In 1937 at the Conference of the Medical Society of Geneva, De Quervain discussed the surgical treatment of the hyperthyreosis. In 1938 he reviewed the progress in study of the thyroid for the past fifty years. More recent investigations include a study of the antagonism of thyroxin to Vitamin A, the possible utilization of short-wave therapy in hyperthyroidism, and many other works directed or instigated by De Quervain. There is not a single phase of hyperthyroidism to which De Quervain and his school have not contributed by their clinical and experimental work. In all his conclusions De Quervain has confirmed and developed the ideas of his master, Theodore Kocher. EDITH SCHANCHE MOORE.

Debeyre, A., and Gineste, P. J.: Experimental Goiters and the Anatomicophysiological Classification of Goiters (Goitres expérimentaux et classification anatomo-physiologique des goitres). *Ann. d' anat. path.*, 1939, 16: 267.

The authors discuss in detail the morphological tests of thyroid activity as developed by Florentin, Aron, Okkels, and Dellys, dividing them into four groups according to their respective values:

1. Hypertrophy of the vesicular epithelium and the multiplication of the chromophobe vacuoles constitute the two major tests of hyperthyroidism. This condition may be confirmed by a number of physiological factors, such as an increase of the basal metabolic rate, elevation of the total blood iodine with thyroxinemia, and diminution of the thyroid iodine level.

2. The second group of tests is of equal value but more difficult of interpretation: the appearance of intravesicular epithelial vegetations, the demonstration of mitoses and direct divisions, and the presence of pluristratified epithelium or of massive desquamations of epithelium in the follicular cavity. Other signs are constant but can be demonstrated only by special techniques. Among these may be mentioned hypertrophy of the mitochondria and of the Golgi apparatus. Finally, certain signs are very reliable but only transitory and have to be demonstrated within a certain limited time after onset of the stimulation. Such are the appearance of the oxidase granulations of Okkels in the initial stages of thyroid secretion and the presence of colloid intracytoplasmic vacuoles, the rapid disappearance of which after two days of stimulation with the thyrotropic hormone was demonstrated by Aleschin in 1935.

3. From an experimental point of view tests of the third group, such as tests of thyroid hypertrophy, cannot be taken as true tests of activation of the glandular secretion. Large goiters may be present in hypothyroid syndromes, and marked vasodilatation may be associated with hyposecretion in certain experimental conditions.

4. In the fourth group are placed morphological tests the value of which has been disputed, such as the demonstration of Bensley vacuoles, the existence of which has been questioned, and the multiplication of full cellular islets, the secretory activity of which appears diminished. Such formations have been noted also in glands subjected to prolonged stimulation.

The conditions permitting an assumption of hyposecretion include flattening of the vesicular epithelium, atrophy of the mitochondria and Golgi apparatus and of the nucleus, abundant and dense intravesicular colloid without vacuoli of resorption, and numerous full cellular islets. According to the predominant vesicular or insular structure the gland takes on the aspect of colloid goiter or of fetal adenoma of Woelfler.

Following a detailed discussion of the histophysiological conceptions of the thyroid secretion and the physiopathology of the phenomena of stimulation in the thyroid gland and their application to the anatomical classification of goiters, the authors submit a tabular classification of goiters based on the conception of a functional cycle of the thyroid cell comprising three successive stages, which are the resting stage or interphase, the stage of accumulation, and the stage of resorption.

There are thus two types of goiters:

1. Goiters due to interruption of the thyroid cycle which result from a dissociated stimulation and determine the predominance of one of the developmental phases of the thyroid cell over the other stages of its evolution.
   a. Blockage at the stage of accumulation of colloid caused by an exaggerated distention of the vesicles, the epithelium of which remains low, an indication of diminished activity. This causes colloid and cystic goiters.

b. Blockage at the stage of functional rest, during the interphase, leads to an increase in the number of Woelfler cords: the insular structure progressively replaces the vesicular structure and the goitrogenic stimulus acts exclusively on the proliferating activity of the thyroid elements. This causes the fetal adenoma of Woelfler.

c. Blockage at the stage of resorption will produce not goiter, but an atrophy of the thyroid gland which succeeds a transitory phase of hyperthyroidism.

2. Goiters due to acceleration of the cycle which are the result of definite stimulation of the thyroid function which produces:

a. A parenchymatous proliferation by increasing the number of mitoses.

b. An equilibrium between the effect of accumulation and the effect of resorption. Thus a lasting hyperthyroidism is established, the clinical and pathologico-anatomical expression of which is Basedow goiter.

From a histophysiological standpoint, the goiters due to blockage of the cycle are accompanied by thyroid hyposecretion and the goiters due to acceleration of the cycle are accompanied by hypersecretion. The experimental findings do not correspond strictly with clinical observations; not infrequently one encounters colloid goiters or adenomas of Woelfler not accompanied by apparent signs of hypothyroidism. Possibly one must in such cases apply the notion of a total mass of thyroid tissue. Each weight unit of goiter functions infinitely less than an equal quantity of normal thyroid parenchyma, but as the goitrous mass is so much more voluminous, the patient presents a subnormal metabolism, and may be said to be hypothyroid anatomically but not physiologically.

Therapeutically it should be borne in mind that every goiter due to blockage of the cycle, whether in diastole (phase of accumulation) or in systole (Woelflerian phase of functional rest), represents a considerable reserve of prehormone or cellular elements. Mobilization of these reserves by restoration of the cycle will lead to basedowification of the goiter. Possibly intensive medication in goitrous subjects may have such an effect. It would seem advisable to refrain in such cases from the administration of thyroid-stimulating substances such as adrenalin, sympathetic stimulants, large doses of Vitamin D, or genital hormones.

The favorable effect of iodine in hyperthyroid conditions may be explained by this conception of a thyroid cycle. It seems probable that the increase in iodemia indispensable for intravesicular accumulation of colloid produces a blockage in the phase of accumulation either by stimulation of the pneumogastric nerve or of the cyanophile cells of the anterior lobe of the hypophysis (Franck), or perhaps by some complex endocrine-negative mechanism in which these two elements intervene.

EDITH SCHANCHE MOORE.

Hurley, T. E. V.: The Goiter Problem, with Special Reference to Etiology and Treatment. *Australian & New Zealand J. Surg.*, 1939, 8: 340.

The thyroid is concerned with the utilization of the oxygen in the tissues. It is closely coupled with the production of thyroxin, for which an adequate supply of iodine is essential. If thyroxin is used at a higher rate than the thyroid is able to supply it, or if the raw materials are lacking, hypertrophy of the cells occurs and goiter develops. If the demands are prolonged and iodine is deficient, the thyroid secretes an iodine-deficient product which may cause disordered physiological function. The administration of iodine will restore normal balance, if the changes are mild, and at least a temporary regression if they are severe. Continued administration of iodine aggravates the symptoms. The cause for this is unknown.

The essential cause of goiter formation is probably uniform; the various types of goiter are manifestations of various stimuli.

In smooth adolescent goiters, iodine is indicated under careful observation for short periods, with other medical measures, such as rest, sedation, and the removal of foci.

Iodine will not cure the nodular enlargements which follow the smooth, diffuse enlargement. It should never be used in these except as a pre-operative measure. In goitrous regions iodized salt may be used as a prophylactic.

The most effective treatment for toxic goiter is a partial or complete removal of the gland. During pregnancy and the menopause, careful medical treatment, including x-ray treatment, may suffice; but operation should be reserved for cases which develop toxic changes. Congestive failure will be much relieved in older patients with adenomatous goiter (the thyroid disease may be masked by the cardiac signs).

Gas and oxygen anesthesia is preferable, and in 90 per cent of patients one-stage operations can be carried out. Paraldehyde or avertin is useful as a basal anesthetic.

If the operation is carried out in two stages, about ten days should intervene. Occasionally the relief is marked by operating on one side only. The operation should be radical. Myxedema can be controlled by thyroid extract.

FRED S. MODERN, M.D.

Rawlins, A. G.: Operative Procedure for the Relief of Stenosis in Double Abductor Paralysis of the Larynx. *Laryngoscope*, 1939, 49: 260.

The treatment for stenosis in bilateral abductor paralysis of the larynx resolves itself into two fundamental procedures: emergency treatment, when necessary, to save the life of the patient, and treatment directed toward the production of a permanent and adequate airway through the natural air channels. The emergency measure is immediate tracheotomy, while medical treatment should be directed toward any systemic disease causing the paralysis.

Fig. 1. Appearance of larynx after operation. Notice the external and low position of the left cord.

Sufficient time should be allowed for functional recovery of the larynx before any type of surgery is considered.

When the recurrent laryngeal nerves have been cut accidentally, suturing the cut ends should, when feasible, be the logical treatment. Unfortunately, this procedure has had little success. Paralysis due to pressure from without or to scar tissue contraction following thyroid or other neck operations necessitates elimination of the tumor causing the pressure or release of the nerves from the scar tissue. Cutting the recurrent laryngeal nerves in order to produce a cadaveric position of the cords has met with no success.

In paralyses due to central nervous-system pathology or to neuritis from diphtheria, influenza, or lead poisoning, or in any case in which atrophy and fibrosis of the posterior crico-arytenoid muscles have developed, some non-physiological surgical treatment may be necessary. It is with this type of case that the author is concerned. Plastic operations to widen the anterior portion of the larynx, surgical removal of the cords and external transplantation, ventriculectomy, and simple removal of the arytenoid cartilages alone are procedures that have not given satisfactory results. Ventriculocordectomy has been fairly successful only in the hands of a few.

Working on Lore's theory, the author modified an operation on cadavers in which Lore did two fundamental things: removal of the adductor muscles that make up the cord, and removal of the entire arytenoid cartilage. This procedure was performed by Rawlins on a woman with bilateral abductor paralysis, who some forty years before had developed a very sore throat, probably from diphtheria. Following this she was very hoarse for about a year and one-half. Her voice gradually returned to normal, but, concurrently, difficulty in breathing developed. Six years later, marked dyspnea came on, gradually becoming so severe that the patient almost died during an acute upper respiratory infection.

On examination the larynx revealed both cords in the median position and on the same level. Preliminary tracheotomy was done, and the larynx well exposed by means of a laryngofissure. Making a horizontal incision just above the left cord, from the anterior to the posterior commissure, the author elevated the mucosa over and below the cord on the left side. Starting at the anterior end and working back to the arytenoid cartilage, he removed the thyro-arytenoid muscle and other tissues making up the cord down to the perichondrium of the thyroid cartilage. The arytenoid cartilage was then dissected free, and the arytenoid removed.

In paralyses similar to this case the author believes this operation should be the method of choice because of the simplicity of the procedure, the ease of postoperative care, the short duration of convalescence, the elimination of a bilateral operation, and the assurance of a good airway.

NOAH D. FABRICANT, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Rossier, J.: A Contribution to the Study of Craniocerebral Injuries. The Pathology of the Subdural Space (Contribution à l'étude des traumatismes crânio-cérébraux. Pathologie de l'espace sous-dural). *J. de chir.*, 1939, 53: 625.

Rossier has made a review of the recent literature pertinent to the subject of the surgical pathology and pathogenesis of varying forms of subdural hemorrhagic lesions. He is in agreement with most American authors that trauma is the usual and major factor in the production of such lesions, whether they prove to be (1) an encysted collection of cerebrospinal fluid between the arachnoid membrane and the dura (following a rent in the arachnoid membrane?), (2) a diffuse spread of bloody cerebrospinal fluid, (3) a recent hemorrhage of fresh, pure blood, or (4) an old subdural hematoma admittedly post-traumatic, which may or may not have existed several weeks or months with little or no symptoms. He makes a careful distinction between any of these forms and spontaneous, endogenous hemorrhage, or so-called pachymeningitis hemorrhagica, due to a diathesis, with typical and marked histological changes in the arachnoid membrane and dura, such as, thickening, brown discoloration, and chronic inflammatory changes. The post-traumatic lesions offer a good prognosis; surgery is the one choice of therapy and it is singularly successful. The hemorrhage of pachymeningitis is *essentially* beyond the reach of surgery. JOHN MARTIN, M.D.

Dandy, W. E.: The Treatment of Internal Carotid Aneurysms Within the Cavernous Sinus and the Cranial Chamber. *Ann. Surg.*, 1939, 109: 689.

The surgical attack upon intracranial aneurysms is just beginning. In the past few years a few cases have undoubtedly been cured by surgical procedures. These procedures have been (1) direct and (2) indirect, the latter being done by means of inducing thrombosis. In the 3 cases treated in this report the aneurysms were trapped between ligatures.

The 3 aneurysms reported all arose in the intracavernous portion of the carotid artery or just where it enters the cranial cavity, and all projected into the cranial cavity alongside the carotid artery; and in each case it is believed that the aneurysm is cured. The aneurysms were trapped by (1) intracranial occlusion made with a silver clip, and (2) ligature in the neck.

The intensive cultivation of any field usually discloses the lesion to be of far greater frequency than we have been wont to believe. The diagnosis may be made with the greatest of ease or with great difficulty. Similarly, the localization may be easy or difficult. Arteriography, as introduced by Moniz, frequently permits diagnosis and localization with precision when the signs and symptoms fail completely or are at least uncertain. They may be divided into two groups: (1) those within the substance of the brain; and (2) those on the surface of the base of the brain. The latter are known or suspected from five disturbances: (1) recurring, sudden, severe pain and headache behind an eye; (2) subarachnoid hemorrhage; (3) palsies of the nerves of the extra-ocular muscles, particularly the third; (4) involvement of the trigeminal and sympathetic nerves; and (5) unilateral loss of vision with primary optic atrophy. Such a syndrome is almost pathognomonic of an aneurysm of the internal carotid artery or of the posterior communicating artery.

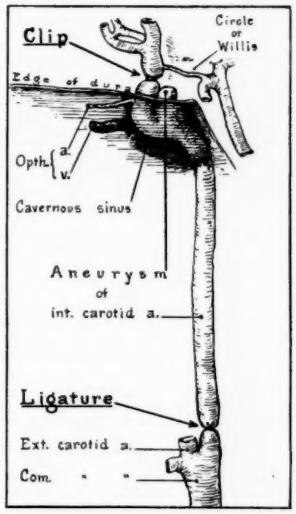

Fig. 1. Diagrammatic representation indicating the position of the aneurysm and the method of surgical attack upon it by trapping the aneurysm between the carotid, intracranially, and the ligature of the internal carotid artery in the neck. (Courtesy of J. B. Lippincott Co.)

Roentgenography may be of considerable aid in the diagnosis of the condition particularly when erosion of the landmarks of the skull has occurred. Arteriography, as mentioned above, has given some beautiful pictures of this condition and promises great help in the diagnosis and localization. And yet one wonders whether the absence of an aneurysmal shadow can be accepted as positive evidence that an aneurysm does not exist, i.e., whether one is justified in excluding an aneurysm on negative evidence.

At the present time the author is reluctant to employ this measure because of the possibility of cerebral damage, but states that with further experience he may well come to its use. There are, however, definite hazards connected with its use which must be weighed very carefully.

The treatment of these aneurysms is surgical. There is no reason for believing that those of the anterior cerebral artery or even the anterior communicating artery should be attended with more risk than one of the carotid artery, but it would be much more difficult to expose those of the posterior communicating or posterior cerebral or basilar arteries sufficiently to "clip" the trunk on both sides of the aneurysm. However, the clipping of one side of the arterial trunk might be adequate. The author prefers exposure of the lesion intracranially for several reasons: (1) the aneurysm can be exposed and the sac ligated, possibly without sacrifice of the internal carotid artery; (2) the diagnosis can be visually confirmed; (3) the condition of the cerebral circulation can be ascertained; and (4) the exact localization of the lesion can be determined. These factors may alter the type of attack to be carried out. The 3 cases reported were explored intracranially and the internal carotid artery was ligated with a clip. The internal carotid artery was later exposed through the neck and ligated. Among the conditions which must be present is an adequate cerebral circulation.

All patients, especially those more than forty years of age, must be subjected to uninterrupted digital carotid compression for ten minutes. It does not insure against eventual trouble but when positive it picks out individuals in whom ligation of the carotid artery would certainly be followed by hemiplegia and possibly death. If the test is positive the only safe procedure would be a partial occlusion of the carotid artery in the neck first preferably with a band of fascia lata. Finally, if evidence of the patency of the aneurysm remains, the intracranial exposure and attack can be carried out without the risk of inadequate cerebral blood supply.

JOHN WILTSIE EPTON, M.D.

Witchell, I. S.: Abscess of the Brain Following Tonsillitis and Retropharyngeal Abscess: Report of a Case and Review of the Literature. *Arch. Otolaryngol.*, 1939, 29: 835.

The author states that localized thrombosis, abscess, or general sepsis follows acute tonsillitis with sufficient frequency to be given first consideration when resolution of an acute tonsillar infection does not take place normally.

When an abscess is formed, its cavity entered, and pus is found and evacuated, prompt subsidence of the infection is expected. In the case reported there was no improvement. Several days of septic temperature followed the incision of the abscess. The possibility of venous thrombosis or dissecting abscesses of the neck was considered. The exploration of the left side of the neck and the left internal jugular vein failed to reveal any extension of the infection. Blood cultures taken with the temperature at various levels were persistently negative. Although the possibility of meningitis was considered, it was not until the twenty-second day of the illness, when aphasia developed, that abscess of the brain was considered.

JAMES C. BRASWELL, M.D.

King, J. E. J.: Extradural Diploic and Intradural Epidermoid Tumors (Cholesteatoma). *Ann. Surg.*, 1939, 109: 649.

The author has successfully operated on 6 of these rare tumors. Until about 1920 they were not diagnosed before death; altogether only 142 were reported in 1936. The term epidermoid is preferred to cholesteatoma, which may be confused with chronic inflammatory lesions about the temporal bone. There are two main sites for these epidermoid tumors which the terms "extradural diploic" and "intradural" describe. Very rarely a spinal epidermoid is found. In 3 cases the nature of the lesion was specified before operation and in each case it was an epidermoid of the extradural diploic type. In 1 spinal and 1 intradural type of lesion, it was suspected though not actually diagnosed. The extradural diploic epidermoids produce a characteristic scalloped, dense, clear-cut margin. The inner table is more involved than the outer and the defect has a dense edge. The tumors grow very slowly and in 1 case an intradural epidermoid was mistaken for a meningioma because of the length of the history. The tumors are well encapsulated and when the capsule is torn or cut there may be a beautiful white mother-of-pearl appearance to the tumor mass. The tumor mass may also be a homogeneous, caseous crumbling structure. In all 8 cases histories are reported in detail with excellent radiographic and other illustrations.

As far as the surgical removal of these tumors is concerned, a great deal depends on their position. The intradural variety is often adherent to the deeper structure, which makes complete removal of the capsule impossible. This is well illustrated in the author's case of intradural tumor in which the petrous tip and the anterior part of the left middle fossa were affected. The extradural diploic variety, on the other hand, should be completely removed with the capsule intact.

ADRIEN VERBRUGGHEN, M.D.

PERIPHERAL NERVES

Aird, R. B., and Naffziger, H. C.: Regeneration of Nerves after Anastomosis of Small Proximal Nerves to Larger Peripheral Nerves: An Experimental Study Concerned with Relief of Peripheral Neurogenic Paresis. *Arch. Surg.*, 1939, 38: 906.

Using dogs in well controlled experiments, the authors undertook studies on the regenerating capabilities of the sciatic nerve, after both immediate and delayed suture. They raised several questions rela-

tive to the eventual functional result: (1) Do a fewer number, the same number, or a greater number of nerve fibers regenerate after simple section and immediate anastomosis of a whole nerve trunk? (2) Does an increased number of regenerating nerve fibers necessarily imply an increased final innervation and function of the muscles supplied? (3) What is the effect on regeneration of delayed suture, a situation simulating the conditions of old peripheral neurogenic muscular pareses? and (4) Can good functional re-innervation be obtained in one group of muscles by the use of nerves supplying antagonistic muscles?

Their results led them to believe that the occurrence of a luxuriant regeneration of nerves does not bear a direct relation to re-innervation of the muscles and the final return of muscular function, and, even though the resulting degree of muscular function may be less than expected after a large regrowth of nerve fibers, it seems possible to obtain very satisfactory recovery in the pareses of peripheral origin by the anastomosis of small proximal nerves to larger peripheral nerves, as, for instance, in carefully selected cases of isolated paresis in poliomyelitis. Synergistic muscle groups may be successfully re-innervated by the anastomosis of a nerve supplying one of those muscles to the peripheral portions of the nerves innervating both groups of the synergistic muscles. The flexor muscles of the leg showed a better functional result than the extensor muscles, even though the common peroneal was the nerve selected for anastomosis. JOHN MARTIN, M.D.

SYMPATHETIC NERVES

Danielopolu, D.: The Present Status of the Operative Treatment of Angina Pectoris (Der gegenwaertige Stand der operativen Behandlung der Angina pectoris). *Deutsche med. Wchnschr.*, 1938, 2: 1604.

The object of treatment of angina pectoris is not the elimination of pain, but the avoidance of the onset of an attack. The pain is but a warning signal. The author's method is that of elimination of the pressor reflexes. Toxic fatigue products stimulate the sensory-nerve fibers, and this stimulus releases the reflex by way of the medulla and spinal cord; the rise in blood pressure causes a contraction of the coronary vessels. One must therefore section as many as possible of the most important centripetal nerve fibers, but must spare the vagus trunk for respiration and the stellate ganglion for cardiac function. The stellate ganglion contains, besides centripetal fibers, also sympathetic fibers to the heart musculature and, in addition, dilator fibers to the coronary arteries. Stellectomy is dangerous, since the already diseased heart suffers a severe damage to its function, or even complete stoppage. The author presents as proof of this statement a number of cases, operated upon elsewhere, in which the patients died soon after the operation. Also, in the most favorable cases in which the heart was in essentially good condition, stellectomy was not survived for long.

He presents cases of others, especially criticizing Jonnescu, who operated upon some hundred cases of various sorts: Basedow's disease, glaucoma, epilepsy, and angina pectoris. Almost none of the latter's patients are living. The alcoholic injection of the superior rami communicantes (Pletnew and White) is physiologically comparable to stellectomy and practical experience seems to support this statement, since sympathetic fibers to the heart and sympathetic fibers to the coronary arteries pass through these rami.

The author's operation consists of bilateral cervical sympathectomy, with avoidance of the stellate ganglion; bilateral section of the communicating rami from c.6 to Th.1 of the vertebral nerve, and of the vertically arranged communications of the vagus which run through the thoracic cavity. Those from Th. 2 to Th. 4 must be spared, since through them run fibers which reflexly maintain the tonus of the dilator nerves to the coronary arteries. Thereby any untoward result would be avoided, and not only pain, but also the occurrence of an attack would be prevented. The last is important as the author demonstrates by 3 cases of White that while people may no longer perceive pain in an attack, nevertheless they can die in one. Up to 1931, in 42 cases of stellectomy there was an incidence of 14 deaths due to heart impairment, while in 51 cases treated by his method, only 1 early death due to the heart occurred. This death occurred in a patient with a cardiac insufficiency.

However, the author does not deny that the next best results, after those obtained from his operation, can be obtained by stellectomy. There are also some centripetal fibers cut by that method, but on the other hand, the dilator fibers to the coronary arteries are sacrificed, and exactly there lies a potential danger. The efficacy of his method is one-third greater than that of stellectomy.

The author also claims that even the patients who are benefited by medical treatment should be operated upon. The possibility of sudden death is never easily foreseen. He operates under a general anesthesia because of the danger otherwise of operative shock. He operates in two stages. In the first, he sections the rami communicantes from C8 to Th. 2, the vertebral nerves, and the branches from the vagus and sympathetic trunks. Only when there is some improvement from this much of the procedure does he do the second stage, a cervical sympathectomy. (FRANZ). JOHN MARTIN, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Mingazzini, I.: The Etiology and Clinical Significance of Loss of Blood from the Nipple (Sulla etiologia e sul valore clinico dello scolo di sangue dal capezzolo della mammella). *Arch. ital. di chir.*, 1939, 55: 165.

Mingazzini describes 8 cases of bleeding nipple encountered during the past five years at the Clinic of the University of Milan among 400 women treated for disease of the breast, mostly tumors. In this series, therefore, bleeding nipple occurred in 2 per cent of the cases of mammary disease. The age of the patients ranged from thirty to fifty-one years, the average being forty-one years, which is markedly lower than that for malignant tumors of the breast. This relatively early age is important in the etiopathogenesis of the symptom, which may be caused by particular conditions of the breast during its period of full glandular activity; it raises the suspicion of a functional disturbance, while a later age would point to malignant tumor. This is fully confirmed by the reported cases, of which 2, in patients aged fifty and fifty-one years, respectively, presented a frankly malignant tumor, and 1, in a patient aged forty-seven years, showed incipient malignant evolution. Seven of the patients were married and had had 2 or more children which they had nursed, with only 1 exception. In 1 woman, the bleeding began after she had nursed her child for four and one-half months, and continued after nursing was stopped. One woman was in the menopause; the bleeding had started three months previously, and histological examination of the tumor revealed the evolution of a fibrocystic mastopathy into a scirrhous atypical epithelioma. No patient showed any relationship between the menstrual cycle and bleeding from the nipple. One patient traced the origin of her tumor to traumatism which was followed by bleeding nipple more than a year later.

Histological examination demonstrated the great preponderance of the fibrocystic and adenomatous dendritic forms of tumor (7 cases). The fibrocystic and hyperplastic lesions never invaded the entire glandular parenchyma, but remained limited to more or less extensive parts, mostly in the vicinity of the nipple. The transition from the healthy to the diseased tissue was gradual, the fatty tissue between the lobules disappearing and being replaced by fibrous connective tissue in which were found acini and alveoli of varying size, lined with epithelium similar to or lower than that of the milk ducts, or more often having various forms and resembling the cells which line the lower part of the axillary sweat glands or of the glands opening in the areola close to the milk ducts. These cells are also found after the menopause in senile breasts. Often the epithelium formed buds in the enlarged and deformed tubules, or villous formations, and the numerous papillæ were ramified to the point of presenting a characteristic dendritic aspect. The vascular network was well developed, well filled with blood, and often surrounded by zones of infiltration of chronic or subacute inflammatory type. Tubes and cysts were often plugged with blood elements, and the connective tissue presented hemorrhagic infiltrations.

Bleeding nipple was the first sign of disease in 5 of the patients; in 1 it preceded the appearance of the tumor by ten years, and in another by six years. In 3 patients the tumor preceded the bleeding, and in 2 of these patients the tumor was histologically malignant. In 2 patients the bleeding was preceded by a sensation of weight in the breast and by pain irradiating to the shoulder. Bleeding nipple is consequently an evident sign of alterations which may have various local or general causes. However, the most frequent cause is a benign or a malignant tumor. When bleeding nipple forms part of the symptoms which denote a malignant tumor, its importance is secondary for the treatment to be followed. If it is present in benign and clinically uncertain forms of tumor, its evaluation is difficult, but it would seem advisable to use radical surgical treatment of the tumor. RICHARD KEMEL, M.D.

Borghetti, U., and De Gasperis, A.: Factors Predisposing to Breast Tumors (Fattori predisponenti ai tumori mammari). *Tumori*, 1939, 25: 1.

In order to discover the possible predisposing factors of breast tumors, Borghetti and De Gasperis have made a clinical and statistical study of 809 cases of disease of the breast in women, including 651 carcinomas, 1 sarcoma, 45 fibrocystic mastopathies, 107 benign tumors, and 4 cases of Paget's disease, and of 6 cases of tumor of the breast in men, observed during the first decade of work at the Victor Emmanuel III National Tumor Institute of Milan.

The data collected on the heredity of breast tumors can appear only as very uncertain in view of the impossibility of following these factors through many generations, as has been done in experimental work. However, a hereditary tendency is found throughout the cases of fibrocystic mastopathy, which is a precancerous lesion based on a disturbance in the endocrine system. This agrees with the observations of other authors who have shown that the hereditary factor applies more to precancerous lesions than to cancer itself.

The data concerning age lead to the conclusion that it is an important factor in the appearance of cancer of the breast, as the frequency of the disease increases gradually with increasing age.

The data collected on the sexual life of the patients reveal the greater frequency of ovarian dysfunction

in cases of fibrocystic mastopathy and, to a lesser degree, in cases of benign tumor; while, on the other hand, normal conditions of menstruation and menopause prevail in cases of malignant tumor. Little importance can be attached to the limited period of the menopause during which there appears to be a greater frequency of breast cancer, as increasing age already accounts for this fact.

The data collected on the civilian status of the patients show that at the more advanced age, which corresponds to the greater frequency of cancer, the affected women are those who have led a less active sexual life, such as unmarried, nulliparous, and pauciparous women with a reduced number of nursings; at a younger age, the most important factor seems to be a succession of pregnancies coming too close together, with resulting exaggerated use of the breast. Pre-existing changes in the breast, such as sequelæ of acute mastitis and rhagades, are unimportant, while the presence of benign tumor or of fibrocystic nodules has some significance. Trauma was found in only a low percentage of the cases and cannot be considered as having any importance.

RICHARD KEMEL, M.D.

Dieulafé, R., and Grimoud, M.: "Swollen Arm" as a Sequel of Treatment of Cancer of the Breast (Les "gros bras" consécutifs au traitement du cancer du sein). *Rev. de chir.*, Par., 1939, 58: 161.

The exact conditions which result in the edema of the arm so frequently developing after surgical treatment of cancer of the breast have been difficult to define, but the incidence of this complication seems to have increased since attempts have been made to improve the chances of lasting cure by more and more extensive exereses and by the combined treatment of surgery and roentgenotherapy. The degree of this edema varies, but amounts in some cases to a veritable elephantiasis. The present dissertation deals with severe edema rather than the type following amputation of the breast for cancer.

These severe edemas may be extremely painful and deprive the patient of the use of her arm and are, moreover, very resistant to treatment of any kind. Etiologically one has to consider two groups of causes. The first is resection of the majority of the lymphatics or veins, or both, which leads to a transitory edema that may persist if the lymphatic or venous circulation is not restored because the region is itself unfavorable, because the muscular resection has been too extensive, or because roentgenotherapy has led to sclerosis of the connective tissue. The second is postoperative developments which are associated with inflammation or cancerous recurrence and lead to extensive obliterating lymphangitis, compressions by sclerosis, adenopathies, tumor masses, or phlebitis. These causes are not so effective because of the stasis which they produce as because of the vasomotor irritation dependent upon them.

There are four causative types of this edema: the neoplastic, the phlebitic, the infectious, and a type without evident cause.

The authors have studied edema in 65 cases as regards site, local temperature, and color, as well as the course and time of onset. Oscillometric studies of the limbs, studies of the tissue hydrophilia (by the Aldrich-McClure test), and a roentgenological study of the skeleton were made. It was discovered that edema of the arm may develop following any treatment for cancer of the breast. The incidence is directly influenced by the therapeutic combinations and the extent of exeresis. Edemas which cannot be explained on the basis of recurrence, phlebitis, or local infection are particularly frequent after extensive operation *per se* or operation combined with roentgenotherapy.

Brachial edema may occur in cancer of the breast in the absence of any treatment. The neoplastic type of edema is common and is characterized by a free interval of variable duration; however, this interval is always definitely between the treatment or treatments and the appearance of the edema. The edema increases progressively and leads to enormous elephantiasis of the limb. Local signs indicate recurrence. There is a syndrome of supraclavicular recurrence in which edema and involvement of the brachial plexus may be present together or singly. In this neoplastic type there are often vasomotor disturbances and, in particular, a marked instability of the arterial blood pressure. The Aldrich-McClure test can, as a rule, not be performed because of the tension of the tissues.

The phlebitic type of brachial edema occurs following the Halsted operation. The authors have seen 19 cases of phlebitic origin. Clinically the phlebitic edemas may be of two types: (a) early, which may be white and depressible, or blue and tense; and (b) late, which is chronic, hard, and organized, with little chance of cure. The latter is accompanied by a whole series of neurosympathetic symptoms, such as atrophy of the skin, disturbed perspiration, and disorders of peripheral heat regulation. The arterial pressure is not much affected. Occasionally there is a slight diminution of oscillometric amplitude. The Aldrich-McClure test is usually but not constantly positive.

In cases in which neither phlebitis nor recurrence can be demonstrated, a search should be made for infection. This type develops often in cases in which the wound was left open because suture was impossible, but even more frequently in cases of sutured wounds (8 cases). It develops very early and is accompanied by unmistakable signs of inflammation, such as erysipelas and suppurating subclavicular hematoma. This type of edema is depressible at first, but may persist after the infection has subsided and the wound has healed. It then develops into the chronic organized type of edema, like that seen in the streptococcic edema of the lower limbs. Not only inflammation but lymphatic stasis plays a large part in the etiology of this type of edema. The Aldrich-McClure test shows no change or acceleration. The arterial pressure is usually increased with diminution of the oscillometric index.

The edemas without demonstrable cause are usually not very important and may retrogress or disappear spontaneously. They vary in color and consistency and they may be associated with neurosympathetic symptoms. In brief, their symptoms indicate their complex nature. Treatment is discussed from a causative, pathogenic, and symptomatic point of view. The limb may be placed in suspension right after operation, with early and prolonged active mobilization. Mild frequent massage is applied and an Esmarch band used to compress the limb from time to time. Albert compresses the axillary or subclavicular artery for a few minutes with a finger with resulting vasomotor reflexes leading to a diminution of edema. The various surgical procedures are designed to increase the return circulation, and include aponeurotic resection with or without resection of the skin and subcutaneous tissue according to the techniques of Payr, Kondoleon, and Sistrunk. Lymphangioplastic intervention has been used in an attempt to create artificial return channels as described by Handley or Walther. All these methods afford only temporary relief and merely postpone the time when amputation of the arm becomes imperative. Prevention is the best method. This may be accomplished by leaving a muscular flap *in situ* to act as a protecting cushion for the neurovascular bundle. Forced suture of the skin is also a factor. Halsted substituted dermo-epidermic grafts, which prevented the creation of a dead space favorable to infection. The present writers have the impression that the more radical amputation of the breast is more likely to be followed by edema of the arm than the classic Halsted operation.

EDITH SCHANCHE MOORE.

TRACHEA, LUNGS, AND PLEURA

Curtillet, E.: Arterial Gas Embolism (L'embolie gazeuse artérielle). *J. de chir.*, 1939, 53: 461.

This article is based on 3 cases of arterial air embolism complicating operations on the lungs. In spite of the voluminous literature which has appeared on the subject many points in the pathological physiology of air embolism have not even been touched upon. Convinced that some of these problems could be solved only by direct microscopic study in the living animal, the author undertook such a study in the frog, and later in the rabbit, with the result that certain new facts were discovered. The terms arterial gas embolism and crossed embolism are defined and a short history of the subject is presented.

In his experiments, the author studied the penetration of the air into the pulmonary veins, its progress through the large and small arteries, and the arrest of the air bubble in the arterioles, where it caused the embolism. He also studied the level of arrest, the local evolution of the arrested gas, the re-establishment of the circulation, the passage of the air through the capillary barrier, the part played by the physical condition of the air admitted to the circulation, the reactions of the blood and vessels, the amount of air leading to a fatal termination, and the cause of death. Finally, a chapter is devoted to the study of crossed embolism.

It is necessary to study separately the course of the embolus through the large arteries in which it is subjected to gravity factors as well as to the action of the blood current, and its course through the small arteries, in which it fills the entire lumen of the vessel. The microscopic study of the course of the air bubble showed that the air never reaches vessels of a caliber of less than 30 μ; in other words it never enters the capillaries. Arrested in the arterioles of from 30 to 40μ in diameter, it is rapidly resorbed. The passage of air from the arteries into the veins may take place as demonstrated by arteriovenous anastomoses of a caliber of more than 30μ, and it is thus comprehensible that such a passage is possible only in regions rich in these canals, such as the limbs and face; except perhaps in case of the kidney, such passage is not possible in the visceral regions as they do not possess arteriovenous anastomoses of sufficient caliber. There can be no doubt that the abnormal existence in the lung of arteriovenous anastomoses of more than 30μ in diameter, of whatever histological type, permits the development of crossed embolisms in spite of the absence of interauricular communications.

The microscope, likewise, permits a demonstration of the mode of restoration of the circulation during the progression and resorption of the air bubble, as well as the nature of the local blood and vessel reactions to the embolism.

The quantity of air leading to a fatal termination was found to be from 0.5 to 3.3 c.cm. per kgm. of animal weight. The causes of cerebral and cardiac death in arterial embolism were studied on the basis of the findings of Allen, Hrdina, and Clark.

From the clinical point of view, the author emphasizes the importance of blindness and the development of symptoms corresponding very well with his microscopic findings. Therapeutically, he suggests the possible preventive value of an inclined position and the probable curative effect of acetylcholine, the vasodilating effect of which would favor progression of the air and the liberation of certain vascular regions. EDITH SCHANCHE MOORE.

Jones, J. C., and Dolley, F. S.: Lobectomy and Pneumonectomy in Pulmonary Tuberculosis. *J. Thoracic Surg.*, 1939, 8: 351.

Certain cases of tuberculosis are cured only by a partial or total surgical removal of the diseased lung. These authors believe that pulmonary lobectomy and pneumonectomy should be used in the modern program of surgical collapse therapy. They admit that this treatment still remains definitely a debatable subject, and report 4 cases in detail and give opinions as to indications for this type of treatment.

The authors state that it is impossible to accomplish complete removal of the tuberculosis of the lungs by lobectomy and pneumonectomy. They think, however, that there is a place for such opera-

tions and give their opinion as to the indications. When the partial or complete removal of a tuberculous lung offers the patient his only chance of cure, and when the patient's general condition apparently is suitable for major surgery a fair indication is present.

In patients having frequent large hemorrhages which are not controlled by collapse with pneumothorax and phrenicectomy, a lobectomy is a far safer procedure than thoracoplasty.

A suppurating lung is not cured by thoracoplasty but is often made worse because of disturbance of the bronchial drainage. Here a lobectomy or pneumonectomy is certainly the procedure of choice.

When tuberculous cavities are present and have failed to close after extensive thoracoplasty, a lobectomy for the residual cavity should be given due consideration.

Another type of lesion that should be treated by lobectomy is an atelectatic, firmly contracted honeycombed lobe, with persistent positive sputum after thoracoplasty has been completed.

There is also the rare unilobar basilar tuberculous cavity which does not heal after the usual procedures of collapse therapy have been employed. Lobectomy should be considered in all such cases if the patients are good or fair risks for major surgery.

The authors state that for years surgeons have been laboring under the false premise that a tuberculous lung should not be touched.

While this is true in the great majority of cases, they believe we should bear in mind the occasional exceptions to the rule and be not too dogmatic in our beliefs. J. DANIEL WILLEMS, M.D.

Benedict, E. B.: Bronchoscopic Dilatation of Bronchial Stenosis Following Thoracoplasty for Tuberculosis. *New England J. Med.*, 1939, 220: 617.

This author recognizes the probability of some degree of tuberculous tracheobronchitis before thoracoplasty in a great many tuberculous lungs; and, further, that the collapse of the lung, with the possible kinking and compression of the bronchi, results in an approximation of the bronchial surfaces and local spread of the tuberculous process, with ulceration and stenosis.

He reports 3 cases of bronchial stenosis following thoracoplasty for tuberculosis in detail. Marked benefit was noted in all these cases after bronchoscopic dilatation. In no case did the bronchoscopy reactivate the tuberculosis.

J. DANIEL WILLEMS, M.D.

Edwards, A. T.: Modern Principles of Treatment in Bronchiectasis, Based on 199 Cases Treated by Lobectomy or Total Pneumonectomy. *Brit. M. J.*, 1939, 1: 809.

Although bronchiectasis is now considered to be a progressive disease, sufficient evidence to provide undoubted proof of this is lacking. By investigation it may be possible to prove that certain types of bronchiectasis are progressive, whereas other types may remain stationary for long periods, or even retrogress. It is definitely recognized that in bronchiectasis following prolonged retention of a foreign body which has subsequently been coughed up or removed, or following the obstruction caused by a benign tumor which after removal has left no narrowing of the bronchial lumen, the disease often becomes progressively worse. Such proof as is obtainable points to the fact that bronchiectasis in children and adults is a progressive disease which in a large proportion of cases ends fatally.

The medical care of bronchiectasis until quite recently consisted of the use of expectorants, the administration of creosote by mouth, and the treatment of complications, such as recurrent attacks of pneumonia and hemorrhage, by bed rest and careful nursing. More recently, however, considerable benefit has been derived from postural drainage. Many patients with widespread bronchiectasis can be kept relatively comfortable, and may lose the fetor often associated with the disease by postural drainage for one-half hour mornings and evenings.

Lately, sporadic attempts at the surgical treatment of bronchiectasis have been made. The use of artificial pneumothorax has been advocated, but when bronchograms are made, even when the lung is well collapsed, the dilations are still visible and often unaffected in size or shape. Artificial pneumothorax, therefore, must be considered unsatisfactory in established bronchiectasis.

The object of phrenicectomy and thoracoplasty is to keep the cavities empty and to prevent the retention of secretion by compression of the lung. In some cases, paralysis of the diaphragm results in improvement, probably as a result of the alteration in the direction of the basal bronchi from a vertical to a horizontal position by the rise in the diaphragm. Thoracoplasty has resulted in great improvement in many cases of unilateral bronchiectasis, but if the disease is localized the pulmonary collapse produced by the operation often occurs at the expense of the relatively normal tissue.

Excepting the risks of the operation itself, all the complications of lobectomy occur as the result of sepsis. They include suppurative pneumonitis, secondary hemorrhage, cerebral abscess, and suppurative pericarditis. Any procedure which permits the safe creation of firm adhesions between the unaffected portion of lung and chest wall will greatly serve to reduce the mortality of lobectomy, by the double benefit of a minimum of pleural cavity to be infected and a minimal amount of respiratory disturbance during and after the operation. The prevention of extensive pleural infection is most important in lobectomy.

A satisfactory way to obtain adhesions is to blow B. P. C. talc powder (magnesium silicate to which 0.5 per cent iodine has been added) on to the unaffected lobe of the lung, which is collapsed by a previous artificial pneumothorax. The air which is introduced into the pleura before operation is im-

mediately withdrawn and the cannula is removed. This procedure (pleural poudrage) is carried out under local anesthesia. Firm adhesions develop within from three to six weeks. There appears to be no deleterious effect on the lung itself.

The indications for lobectomy may be summed up by stating that bronchiectatic patients between the ages of four and forty years, in whom the disease is reasonably localized and infected, and in whom there is no serious general contraindication, should be considered as candidates for radical excision of the portion of lung affected. Lobectomy and pneumonectomy provide the greatest advance in the treatment of bronchiectasis. They are procedures which are associated with a mortality that should be negligible if the disease is treated in its early stages, and which have a high proportion of curative results.

SAMUEL KAHN, M.D.

Bohrer, J. V., and Lester, C. W.: Late Results of Lobectomy for Bronchiectasis. *J. Thoracic Surg.*, 1939, 8: 412.

These authors report on a series of 10 patients in whom lobectomy was done for bronchiectasis. All of the patients were children. In 1, a single-stage pneumonectomy was done; in 2, complete pneumonectomies were done, in which the upper lobe was removed at the second operation; in 1, the right lower and middle lobes were removed; and in the remaining patients lobectomy only was done.

In all patients in whom the entire pathological pulmonary tissue was removed, a cure resulted. In those patients in whom the lower lobe was removed, and in whom there was only slight involvement of the upper lobe, the disease progressed and necessitated later removal of the upper lobe. The authors believe that whenever it is feasible a pneumonectomy in stages is indicated. There have not been any postural deformities following these operations. It was not found necessary to do a thoracoplasty following the pneumonectomy, but phrenic resection, or crushing of the phrenic nerve to obliterate the space caused by the pneumonectomy was essential. No visceral or circulatory disturbances were caused by the elevation of the diaphragm, or by the shift of the mediastinum.

The electrocardiogram of all these patients was found to be essentially normal. No cardiorespiratory disturbance was noted, even in the case of a child in whom the heart was in a transverse position. The bronchospirometric curves, and the oxygen, and carbon-dioxide content of alveolar air were not determined, but clinically there was no disturbance in the pulmonary interchange of gases. The patients were able to undergo violent exercise with a normal amount of fatigue.

Histologically, emphysematous dilatation of the remaining lung was found in 1 case at autopsy. When unilateral diseased lungs were operated upon there was no spread to the other lung.

Physical development in these children after operation was normal. The normal angle between the stem bronchus and the trachea was shown to be increased on the uninvolved side and decreased on the operated side. This caused some difficulty in the passage of a bronchial catheter in the stem bronchus of the uninvolved lung.

The authors have found that medically treated patients do surprisingly well, but that endless, intelligent, methodical attention is required. The mortality of patients not operated upon, at least up to the age of twenty years, is not great. Recurrent pneumonitis and metastatic brain abscess account for most of the deaths. Moderate or even advanced bronchiectasis is not incompatible with fair longevity, but social ostracism and mental complexes are very common handicaps.

In conclusion, these writers speculate on the future surgery of bronchiectasis and predict that surgical relief will be very much more frequent during childhood, for soon the pediatricians will not hesitate to refer these patients to the thoracic surgeon for cure, and thereby greatly reduce the incidence of bronchiectasis in adults. Children withstand the operation better than adults.

Surgery is the only cure; it will obviate complications and prevent deformities, and therefore will prevent ostracism of these patients.

J. DANIEL WILLEMS, M.D.

Churchill, E. D., and Belsey, R.: Segmental Pneumonectomy in Bronchiectasis. *Ann. Surg.*, 1939, 109: 481.

Greater precision in diagnosis and operative technique now indicates that the bronchopulmonary segment may replace the lobe as the surgical unit of the lung. Bronchiectasis is frequently limited to one or more bronchopulmonary segments within a lobe, the remainder of the lobe being normal. It also tends to be primarily multilobar in its distribution. This characteristic of the disease provides a rational basis for proposing the resection of diseased bronchopulmonary segments from several lobes, if necessary, with the conservation of normal lung segments, rather than the continued removal of entire lobes as unit structures. This principle finds particular application in early cases of bronchiectasis and those with a bilateral distribution.

A recent survey of cases at the Massachusetts General Hospital revealed that the lingula segment of the left upper lobe is involved sufficiently to demand resection in at least 80 per cent of the cases of bronchiectasis of the left lower lobe, the most common site of the disease. The disappointing clinical results of some lobectomies can be explained by the failure of workers to appreciate this high incidence, and the perpetuation of cough and sputum attributed to residual disease in an unresected lingula. The lingula process of the left upper lobe stands, therefore, as an anatomical entity of great practical significance.

The anatomy of the lingula process is described and illustrated in detail, and the clinical visualization of the lingula bronchus by lipiodol bronchog-

raphy is discussed. The lingula process may be considered as a homologue of the right middle lobe. It occupies a corresponding position, but, while the fissure between the upper and middle lobes is usually well-developed on the right side, on the left side this is uncommon.

The operative technique of resection of the lingula is also described.

In the authors' series, the lingula has been resected with the left lower lobe in 44 cases. It has also been resected without removal of the lower lobe in 1 instance, and at a period subsequent to lower lobe lobectomy in 1 instance. There have been no deaths in this series. Bronchial fistulæ have closed spontaneously, with 1 exception. This complication may or may not be attributable to the lingula resection, or may have been due to the fact that the posteromedial division was removed and bronchiectasis was left in the anterolateral segment.

In conclusion, it is suggested that the bronchopulmonary segment may replace the lobe as the surgical unit of the lung. SAMUEL H. KLEIN, M.D.

ESOPHAGUS AND MEDIASTINUM

Schubert, W.: The Pathogenesis of Esophagitis (Zur Pathogenese der Speiseroehrenentzuendung). *Arch. f. path. Anat.*, 1938, 303: 158.

The inflammatory changes of the esophageal mucosa have been given very little consideration because the picture of esophagitis macroscopically resembles the autopsy appearance of the well known acid esophagomalacia; however, histological examinations show that in these cases intravital inflammatory processes are very often responsible. The author has, therefore, examined 100 esophagi histologically after a careful macroscopic study. In this investigation it was found that only 37 esophagi were free from pathological findings; 50 showed chronic inflammatory infiltrations of the individual mural layers; and acute inflammatory changes were found in 13. Consequently, esophagitis is not so very rare.

Altogether, 34 cases of acute esophagitis were examined. Macroscopic changes could be found only in the lower third of the esophagus, and only in 4 cases were such changes present in the other parts. Stripe-shaped changes were found in the course of the longitudinal folds, as well as flatly shaped extensive foci. They were usually of a dirty brown color or showed a markedly reddened mucosa with whitish deposits. In the histological examination all forms of the inflammation were found; the catarrhal-erosive, the pseudomembranous, and the ulcerated or phlegmonous esophagitis; the patients that showed these individual stages of the inflammation in a developmental series were always markedly emaciated. These inflammations are the same that are found also in the intestinal mucosa, without the characteristics of any specific injury; one cannot, therefore, as Hamperl has done, draw specific conclusions as to the cause. Only in a third of the cases could the author demonstrate any effect of the gastric juice. This effect of the gastric juice is therefore probable, but a healthy esophageal mucosa is definitely insensitive to the effect of gastric juice. The simultaneous occurrence of esophagitis and gastro-intestinal ulcers was found in only 4 of the 34 cases examined. The injured esophageal mucosa offers the gastric juice and other noxa only slight or no resistance. Among these injuries circulatory disturbances are the most important, and in 25 cases they could be definitely demonstrated. Similar changes may also be caused by cachexia or other emaciating diseases. Local circulatory disturbances also lead to such inflammations of the mucosa; in one case it was a submucous hemorrhage, in another a thrombus formation in the submucous veins, and in a third an arteriohyalinosis. Metabolic disturbances produced by diabetes were the cause of the esophagitis in 3 cases. The condition was therefore produced by the gastric juice, the primary factor being the reduction of the resistance power of the esophagus, while the gastric juice was one of the various exciting factors.

(SALZER). LOUIS NEUWELT, M.D.

Hunt, W. M.: Periesophageal Abscesses: The Importance of Early Surgical Interference. *Ann. Otol., Rhinol. & Laryngol.*, 1939, 48: 128.

This report is concerned with infection of the mediastinum in the cervical region, following a rupture of the esophagus. The causes of rupture of the esophagus are: (1) foreign bodies, (2) instrumentation, and (3) spontaneous rupture accompanying malignancy.

Briefly, the diagnosis of a cervical periesophageal infection is suggested by (1) the suspected or observed perforation by a foreign body, instrument, or malignancy; (2) the marked collapse of the patient observed at the time of perforation; (3) pain, tenderness, and swelling over the area; (4) the inability to swallow; (5) the absence of dyspnea unless a pneumothorax has occurred; (6) an increased leucocyte count of from 15,000 to 23,000—usually the higher; (7) a sudden rise of temperature, though seldom higher than 103° F.; (8) definite evidence by roentgen examination of a widening of the prevertebral or post-tracheal space; and (9) emphysema which may be readily ascertained by palpation or observation, or which may be recognized only by roentgenological examination. The roentgenogram is the determining factor in diagnosis, and is of aid in the differentiation between a simple cellulitis, which might disappear, and an abscess formation with a bubble of air. Daily roentgenograms should be made following any known perforation.

External incision and drainage may be performed immediately upon the diagnosis of esophageal perforation. Intra-esophageal treatment should be used only in the most selected cases. It may be better surgery to deliberately open and pack off any known esophageal rupture before an abscess has developed.

The technique of operation is described, and clinical case reports are presented. It would seem from these reports that early surgical drainage of these areas is definitely indicated and that the mortality is low if drainage is thoroughly established while the infection is localized in the region of the perforation. Untreated cases are fatal if a real abscess has developed. SAMUEL H. KLEIN, M.D.

Bohrer, J. V.: Esophagogastrostomy for Carcinoma of the Esophagus. *Ann. Surg.*, 1939, 109: 555.

Lesions in the region of the esophagus and cardiac portion of the stomach long defied surgical attack because of the need of a transpleural approach, because of the absence of a serous coat from the esophagus, and because of the menace of postoperative mediastinitis. Advances in technique have partially overcome at least two of these factors.

The author reports the case of a forty-six-year-old woman who had an obstructing, annular, squamous-cell carcinoma at the lower end of the esophagus. Anemia and weight loss were marked. The stomach was contracted, holding only 4 oz. of fluid.

In preparation for operation a Levine tube was passed through the nose and into the stomach and a high caloric diet was given. Left pneumothorax was induced ten days before operation. Operation was done through a left anterior thoracotomy at the level of the eighth rib. A short radial incision through the left side of the diaphragm and esophageal hiatus allowed delivery of the gastric cardia into the thorax. The tumor was resected, and starting at the greater curvature, the stomach was closed down to an aperture just large enough to permit anastomosis with the esophagus. This was done with interrupted silk sutures in two layers with some reinforcement to the adjoining structures. A Levine tube was passed to the stomach and the wound was closed. On the seventh day a small fistula opened alongside of the thoracotomy drainage tube, and oral feedings emerged here. Accordingly a jejunostomy was done and all feedings were given through it. This induced hyperperistalsis with almost immediate evacuation. The fistula seemed to be closing, the patient remained afebrile, and then suddenly she died on the twenty-seventh postoperative day, presumably of cerebral embolism.

Autopsy showed failure of the mucosa to heal at the site of the anastomosis, and communication of the fistula thus formed with the pleural cavity. Small metastases were found in the liver and in the regional lymph nodes. There was also a fibrinopurulent pleurisy on the left side. The author believes that the inlying Levine tube may well have exerted constant pressure on the suture line and induced partial breakdown. He expresses a definite preference for the thoracic route in the treatment of lesions in this region. AUGUST JONAS, JR., M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Tuch, A.: Spontaneous Rupture of the Abdominal Muscles (Ueber spontane Ruptur der Bauchmuskeln). *Eesti arst*, 1938, 17: 521.

Two cases of spontaneous rupture of the abdominal muscles without external violence are reported: The first was a rupture of the left rectus muscle with a fist-sized hematoma from a branch of the inferior epigastric artery; it was apparently caused by severe strain during physical labor. Operation was done under the suspicion of volvulus of the sigmoid. The second was a rupture of the right rectus muscle with a plum-sized hematoma in the muscle. It was operated upon with the diagnosis of ovarian cyst. There had been a chronic cough. About 150 cases of ruptured abdominal muscles have so far been reported, but they probably occur much more frequently.

The rectus muscle is most often involved, the oblique or transversus less frequently. The following large vessels may be torn: the superior and inferior epigastric, and the superficial and deep circumflex iliac arteries. The rupture occurs from abdominal pressure due to contraction of the abdominal muscles. Etiologically, there may either be extraordinary strain on normal muscles as in sports and tetanus, or there may be physiological contractions, such as coughing, yawning, vomiting, and defecation, in the presence of diseased muscles presenting waxy or hyaline degeneration following infectious diseases. Typhus, tetanus, diphtheria, cholera, influenza, trichinosis, syphilis, tuberculosis, and abscesses, therefore, play a rôle in the history. Waxy degeneration, however, can also occur from chronic lesions causing coughing or constipation. The incidence of rupture in obese abdomens in otherwise healthy persons suggests fatty infiltration of the muscle. Rupture during pregnancy is due to diseased musculature in the form of myositis fibrosa.

Herlyn states that a correct diagnosis was made only 7 times in 37 cases. The picture may resemble that of an intra-abdominal process because of pressure of the hematoma upon the peritoneum, or because of small tears in the peritoneum. On the other hand, there may be absence of pain at the site of the hematoma. It is important that hematomas in the rectus muscle are movable transversely, but not vertically, and that they do not extend beyond the medial margin of the rectus. They may extend from the symphysis to the rib margin. If deep lying vessels are torn, pain occurs first, and the hematoma later.

A hematoma may become absorbed, or it may become encapsulated and form a cyst; it may suppurate and lead to extensive scar formation, or even give rise to tumor formation. Also, a hernia may develop as a result of fascial and muscle tear. Pressure upon the bowel and hemorrhage therefrom has also been described. The treatment of choice is operation. If the hemorrhage cannot be stopped, the hematoma should be evacuated and drainage instituted. (R. Armsen). Leo M. Zimmerman, M.D.

Previtera, A.: The Common Mesentery (Sul mesenterium commune). *Arch. ital. di chir.*, 1939, 55: 331.

By common mesentery is meant a disturbance of the dynamic evolution of the median loop so that there is a failure of coalescence of the mesentery with the parietal peritoneum. With increased x-ray, surgical, and autopsy studies the condition has become better known. After a résumé of some of the pertinent literature the author describes the normal process of development and rotation of the bowel. He then discusses the various theories offered to explain the condition and divides the cases into 4 groups.

In Group I he suggests that there may be failure of intestinal rotation where the small intestine remains in front of the colon, with the duodenojejunal flexure in the mid-line. Here the splenic flexure is lacking, and the small intestine, cecum, and ascending colon are attached by a common mesentery to the posterior abdominal wall.

In Group II, with incomplete rotation, the small intestine is situated to the right and the colon to the left of the mid-line.

In Group III there is an inverted rotation of the umbilical loop.

Group IV includes cases in which there is a perverted rotation of the median loop of bowel.

The author concludes that the common mesentery depends most often on disturbed rotation of the umbilical loop of bowel.

The most common symptoms are of a mechanical nature as characterized by volvulus, torsion, and invagination. Surgical treatment aims at restoration of normal conditions to the intestinal attachments, according to the findings in the individual case. The author reports 1 such case in detail with x-ray findings. An extensive bibliography on the subject is included. Jacob E. Klein, M.D.

Benedetti-Valentini, F.: Acute Torsion of the Omentum Free in the Peritoneal Cavity (Torsione acuta dell'omento libero nella cavità peritoneale). *Policlin.*, Rome, 1939, 46: sez. chir. 153.

The author reports the case of a man, aged forty-one years, who, nine years previously, had been operated upon for right inguinal hernia which recurred after eight months, and who was now admitted with the diagnosis of acute appendicitis and diffuse peritonitis. Operation revealed the presence of a large quantity of strongly hemorrhagic fluid in the peritoneal cavity and of an omental mass slightly adherent to the cecum, the neighboring

loops of the small intestine, and the parietocolic recess. Exteriorization of the omentum disclosed a pedicle, not thicker than a finger, twisted on its axis five or six times from right to left, and corresponding to the colic insertion of the omentum. When the pedicle was straightened out, its volume and surface did not change, and the omentum was consequently resected. Recovery was uneventful. Histological examination of the specimen showed diffuse recent hemorrhagic infiltration, some zones of sclerosis, but no actual inflammatory foci.

There is no single classification of omental torsions, as each author has used different criteria on which to base his own. According to Payr's classification, which is partly anatomical and partly clinical, there are two types: (1) without hernia, and (2) with hernia. The present case falls in the second group because of the presence of a hernial sac. This sac was empty at the time of the incident, and the torsion occurred in the free abdominal cavity.

Various ingenious explanations have been given to account for the origin of torsion of the omentum; the co-existence of hernia, especially on the right side, seems to have a double importance in that it predisposes to irritative chronic inflammation of the omentum and is a determining factor in the initial movement of torsion.

The result of torsion is marked stasis in the omentum with alteration of the walls of the vessels and transudation of blood, which within a short time causes the appearance of clinically demonstrable hemoperitoneum. Necrosis of the pedicle may occur with complete separation of the omental mass. The peritoneal serous membrane reacts with agglutination of the viscera around the altered omentum; the viscera may be displaced; and torsion of the colon may occur and lead to occlusion. Total or partial gangrene may be followed by suppuration and real peritonitis, while total or partial rupture of the pedicle may cause fatal hemorrhage.

The symptoms of omental torsion may be said to be those of torsion of the ovary, and roentgen examination after the administration of an opaque enema will show the transverse colon pulled down and to the right with such an evident angulation that it can rarely be misinterpreted. The point is to remember the possibility of the presence of hemoperitoneum due to omental torsion, especially when the patient has an old hernia. When to this symptom are added sudden abdominal pain, peculiarly fleeting intestinal paralysis, a low grade of temperature and of abdominal defense in association with a high grade of supposed peritoneal inflammation with copious exudation, the early formation of a flattened tumor in the right lower abdomen, the persistence of humidity of the tongue, and the absence of tachycardia, it is hardly possible to make a diagnostic error. Early surgical intervention is indicated; the omentum is removed after single high ligation of the pedicle; several ligatures of the omental implantation on the colon are rarely necessary.

RICHARD KEMEL, M.D.

GASTRO-INTESTINAL TRACT

Felsen, J., and Lewis, B.: Acute Segmental Appendicitis: Experimental and Clinical Studies. *Arch. Surg.*, 1939, 38: 755.

Not only does a segmental type of acute appendicitis occur, which is characterized by a sharply demarcated lesion involving only a part of the organ, but occasionally "skip" appendicitis is found, in which 2 or more areas of focal inflammation are separated by apparently normal appendiceal tissue.

The experimental production of acute segmental appendicitis in the rabbit rests on 2 basic factors: (1) the peculiar segmental distribution of the appendiceal blood supply; and (2) the striking similarity of the pathological picture observed after vascular ligation in the rabbit to the pathological process observed in man.

Ligation of the main vessels and secondary branches of the cecal appendage (appendix) of the rabbit was followed by a sharply segmental type of appendiceal necrosis which, in general, corresponded to the distribution of the occluded vessels.

The degree of severity of the subsequent pathological process depended on the extent of the vascular block and the duration of the occlusion.

There appeared to be little difference in the results, whether the main artery and vein were ligated singly or concomitantly with the secondary branches, except that a more hemorrhagic type of infarction with free intraluminal blood was seen when the vein alone was occluded in addition to the secondary vessels.

The earliest segmental changes noted, from eight to nine hours after ligation, were limited to the mucosa and submucosa. At ten hours the serosa was covered with purulent exudate.

Complete gangrene with sloughing of the affected segment occurred in approximately twenty-four hours after vascular occlusion.

Microscopic evidence of lateral extension of the inflammatory process beyond the line of demarcation was usually limited to the serosa, the overlying coats being unaffected.

The area of intramural spread of infection was wedge-shaped, the base of the wedge being formed by the serosa.

The general microscopic picture of acute segmental appendicitis in man follows closely the changes associated with the same condition in the rabbit. The early lesions are superficial and are limited chiefly to the mucosa and lymph nodules. The intramural spread of the infection follows the general direction of the submucosal, intramuscular, and intermuscular lymphatic networks until it reaches the serosa. It is wedge-shaped and resembles the process of lymphatic extension in carcinoma of the bowel. The mucosal lesion is usually much smaller in extent than the serosal area of inflammation. The line of demarcation, which is visible in the gross specimen, exhibits the same sharply segmental type of necrosis in both rabbit

and man. The time necessary for the production of complete necrosis of the appendix appears to be somewhat shorter in man than in the experimental animal. The discrepancy, however, may be due to the difficulty of establishing the exact time of onset of the pathological involvement.

From an anatomicopathological standpoint, there are 2 obvious points of similarity between segmental appendicitis in the rabbit and the same condition in man: (1) the vascular supply in both is of the terminal type; and (2) the clearly defined segmental lesions produced by vascular ligation in the rabbit resemble, both grossly and microscopically, those observed in man.

Whether the blood vessels are affected by systemic toxins or by bacteria from a distant focus, or whether they are obstructed secondarily by distention of the lumen, by angulation, or by foreign bodies, the theory of vascular occlusion as the cause of segmental appendicitis seems plausible. The applicability of this theory to the pathogenesis of appendicitis in general is also suggested.

SAMUEL KAHN, M.D.

Sylvestre, C.: Inflammatory Tumor from Non-Resorbing Ligature of the Appendiceal Stump (Tumor inflamatorio por ligadura no reabsorbible del muñón apendicular). *Bol. Soc. de cirug. de Rosario,* 1939, No. 1.

When the patient came to the author's attention he had been operated upon for chronic appendicitis ten months previously. He complained of abdominal disturbances with slight pain, colic, and fever of 38° C. Examination revealed a tumor of the right iliac fossa. None of the clinical, roentgenological, and biological investigations had given an inkling of the correct diagnosis. The topography of the lesion showed involvement of the cecum.

Operation was done under gas narcosis. The laparotomy revealed an inflammatory tumor, in the center of which, corresponding to the iliocecal junction, was a loose ligature of linen.

After biopsy of the swollen mesentery and of a ganglion, the abdomen was closed with drainage. The postoperative course was uneventful and the tumor disappeared quickly. The pathological examination showed a simple inflammatory condition.

The author believes that there are chemical or physical factors in the linen thread, which in some cases provoke an inflammatory, non-infectious condition, which in turn attempts to eliminate the foreign body. However, as these factors are not infectious, a suppuration never arises.

HECTOR MARINO, M.D.

Pemberton, J. deJ., and Stalker, L. K.: The Surgical Treatment of Complete Rectal Prolapse. *Ann. Surg.,* 1939, 109: 799.

For many years it has been the practice of one of us (Pemberton), in order to aid in the exteriorization of growths that are low in the sigmoid or in the rectosigmoid, to divide the pelvic peritoneum at its point of reflection and to free the rectum from the hollow of the sacrum down to the tip of the coccyx. Normally the posterior walls of the lower part of the sigmoid and of the rectum are only loosely attached to the hollow of the sacrum by areolar tissue. This portion of the bowel then can be pulled up out of the hollow of the sacrum and, in many instances, the lower part of the sigmoid and the rectosigmoid can be completely exteriorized as in a Mikulicz type of operation. This procedure leaves a cavity between the hollow of the sacrum and the rectum, and it was our observation that in many of these cases this cavity filled in with a ridge of scar tissue which produced firm fixation of this portion of the bowel. It was reasoned that if the pelvic colon could be pulled up until the rectum was taut and held in this position, at least temporarily, by sigmoidopexy, the rectum would become fixed in this taut position by the formation of scar tissue in the hollow of the sacrum and complete rectal prolapse thereby could be cured.

The technique of this operation for rectal prolapse is as follows:

The patient is hospitalized for two or three days of pre-operative preparation, during which time the bowel is emptied by the administration of saline purgatives, colonic irrigations, and use of a diet of which the residue is less than that of a regular diet but more than that of a non-residue diet.

The operation usually is performed under spinal anesthesia. The patient is placed in the high Trendelenburg position and the abdomen is opened through a left paramedian incision which extends from the symphysis pubis to a level just above that of the umbilicus. A Balfour, self-retaining retractor is inserted, the small bowel and upper part of the abdomen are separated from the pelvis by a moist gauze pack, and, if the patient is female, the uterus is retracted anteriorly.

The sigmoid, which frequently is found rather elongated and more mobile than usual, is gently pulled up until taut and an incision is made in the peritoneum on both sides of the mesentery of the bowel and carried forward toward the bladder. The peritoneum usually is not freed for a very great distance laterally, but it is advisable to identify the ureter on either side at the brim of the pelvis. Care also is taken not to injure the inferior mesenteric vessels, and rarely is ligation of any of these branches necessary.

Next the bowel is lifted and, with a hand behind it in the hollow of the sacrum, the rectum is freed by blunt dissection. The hand is carried downward and forward until the dissecting fingers are felt at the tip of the coccyx. This allows the prolapsed portion of the rectum to be pulled up from the hollow of the sacrum. With the rectum held taut, the reflected flaps of peritoneum are closed over this potential cavity and the raw surfaces of the bowel are peritonized. It is important to fix this elevated portion of bowel in its elevated position. This portion of the bowel may be treated in various

ways, which depend on its length and mobility and whether the patient is male or female. In the main, however, the bowel is fixed in its elevated position by its suture to various portions of the abdominal wall and to the pelvic organs. Frequently it can be supported by a combining suture of the portions of the mesentery of the two loops of elevated bowel and further by attachment of the bowel to the uterus. In some cases the bowel is sutured to the peritoneum of the lateral walls and to the brim of the pelvis, in other cases, to the anterior abdominal wall. In every instance care must be taken in placing the sutures onto the wall of the bowel lest leakage from the bowel results. Commonly the colon can be adequately anchored by the suture of fat tags to the supporting tissues and, when it is necessary to suture the wall itself, the needle should pass through only the peritoneal coat. Care must be taken not to leave an opening through which a portion of small bowel might herniate.

After the operation, in order to avoid gaseous tension in the rectum, a rubber tube is passed through the anus and is left in place for four or five days. During this period the bowels are kept constipated and a non-residue diet is prescribed. Following this period the constipation is relieved by the administration of oil enemas and of mineral oil by mouth. The diet is gradually increased and the stools are kept soft by the frequent administration of oil. The patient should remain in bed for two weeks following the operation and then should be cautioned to avoid strenuous efforts for from three to six months.

During the past two years we have performed this type of operative procedure on 6 adult patients with complete rectal prolapse, but we realize that the success or failure of an operation cannot be evaluated until a large group of patients have been studied over a long period. However, in view of the many poor results that have been obtained in advanced cases of complete rectal prolapse when other operations have been employed, and because of the theoretical soundness of this operation and the excellent immediate results in these 6 cases, we were encouraged to present it for consideration.

Stone, H. B.: Megarectum and Megasigmoid. *Ann. Surg.*, 1939, 109: 791.

The author reports the cases of 2 patients with segmental gigantism of the colon. In 1, the condition was the result of deformities incident to an imperforate anus at birth. It had been opened by a stab wound in the anal position, but the opening had never been exactly satisfactory and had required many operations in an attempt to improve it. Having no spontaneous desire for defecation, the patient's bowel would frequently fill up with fecal material which he had to wash out laboriously. Between times there was a constant slight seepage of fecal material.

Operation was performed in 2 stages; (1) the removal of the tremendous fecal reservoir and production of an adequate outlet; and (2) the establishment of sphincteric control. The first part was carried out somewhat as the first portion of a Miles abdominoperineal resection for cancer. The sigmoid was freed of peritoneal covering, the mobilized bowel was pushed into the pelvis, and the pelvic peritoneum closed over it to form a new pelvic floor. The abdomen was then closed, the patient placed in the lithotomy position, and the scarred anal opening excised through a generous oval incision. The rectal wall was dissected from the surrounding structures until the mobilized area was encountered. The freed gut, drawn through the perineal incision, was amputated and the edges stitched to the perineal skin. The author states that if he were to do this operation again, he would mobilize the bowel but would not construct a new pelvic floor until after the completion of the perineal portion of the operation. It is believed that by avoiding the repair in the early part of the operation, the difficulty in crowding down the bulky gut into the pelvis would not arise, a more extensive resection could be done, and a more secure pelvic diaphragm would be obtained.

The wound healed with a moderate amount of infection, but there was some upward retraction of the mucosa, with the result that the anal opening was somewhat funnel-shaped. Later an attempt was made to construct an artificial sphincter by the use of fascia lata and bundles of the gluteus maximus muscle. This procedure was only moderately successful.

The second case was that of an old man who had an excessively redundant sigmoid, for which no cause could be ascertained. This man had no great symptoms and no surgery was recommended.

JOHN WILTSIE EPTON, M.D.

David, V. C., and Loring, M.: The Relation of Chronic Inflammation and Especially Lymphogranuloma Inguinale to the Development of Squamous-Cell Carcinoma of the Rectum. *Ann. Surg.*, 1939, 109: 837.

Squamous-cell carcinoma of the anus is relatively uncommon and comprises less than 2 per cent of all the cancers of the rectum. The relationship of fistula-in-ano to the development of squamous-cell carcinoma has received some attention in the literature. In a series of over 500 cases of rectal fistula the authors have seen but 1 instance in which a squamous-cell carcinoma developed in the chronic inflammatory tissue of the fistula. The authors have examined over 300 cases of lymphogranuloma inguinale with rectal manifestations and believe that there is a definite association between the irritation produced by this latter condition and carcinoma. They report a case which was seen twenty years ago before a specific diagnosis of lymphogranuloma inguinale could be made by the Frei test. The patient was a female, aged forty-five, who had been under their care for several years with a typical progressively developing stricture of the rectum, which is characteristic of lymphogranuloma inguinale. Colos-

tomy was advised, but refused. She developed a perirectal abscess and draining fistulas. After several years of suffering there developed an induration in the ischiorectal fossa which broke down. These occurred at the site of the fistulous tract. The lesion was found to be a squamous-cell carcinoma.

During 1938 the authors lost 2 patients with squamous-cell carcinoma, each of whom had advanced lesions of lymphogranuloma inguinale of the rectum. In both of these cases the patient had been under the authors' care for several years, and an autopsy in both instances proved the presence of carcinoma.

The authors have been able to find in the literature only 2 cases of lymphogranuloma inguinale of the rectum complicated by the development of squamous-cell carcinoma. Another patient who had a lymphogranuloma inguinale developed a squamous-cell carcinoma in the vaginal fornix.

ROSSER in the discussion states that they have had a total of 16 cases of malignancy in the anal canal apparently induced by fistulas, hemorrhoids, ulcers, or chronic similar lesions. In 9 of these cases the lesion was not a squamous-cell cancer, but an adenocarcinoma. They have had over 200 cases of lymphogranuloma inguinale involving the rectum, and in none did a squamous-cell cancer develop, so that he differs with David who states that the sequence is of usual occurrence.

SINGLETON, in discussing David's report, states that since 1920 they have had at the University of Texas Hospital in Galveston 181 clinically proved cases of lymphogranuloma inguinale with rectal involvement. In the entire group not 1 developed carcinoma. The explanation is that these patients do not live very long and comparatively few reached the age of sixty. In the same period of time they had 47 adenocarcinomas of the rectum and 7 epitheliomas, or flat-celled carcinomas. None, however, were preceded by lymphogranuloma inguinale.

ALTON OCHSNER, M.D.

Grinnell, R. S.: The Grading and Prognosis of Carcinoma of the Colon and Rectum. *Ann. Surg.*, 1939, 109: 500.

A series of 223 cases of carcinoma of the colon and rectum has been studied. Adequate follow-up records were obtained in 205, or 92 per cent. The 4 criteria for histological grading, glandular arrangement, invasiveness, nuclear polarity, and number of mitoses, were found to be of value from the follow-up results.

Both a numerical and non-numerical method of grading were tried, based on the 4 criteria selected. As both gave very similar results, the non-numerical method was adopted because of greater simplicity. Three grades of malignancy were used instead of the usual four.

Most of the cases were classified as Grade I or II. There were 19 per cent more tumors of Grade I and 16 per cent fewer of Grade III in the colon than in the rectum, this fact suggesting that tumors of the colon tend to be better differentiated than those of the rectum. Most of the simple "colloid" tumors were of Grade I, and nearly all those of the signet-ring type were of Grade III.

A definite relationship was found between the follow-up results and the grade of the tumor. The chances of living five years without recurrences were three times as good for the patients with Grade I tumors as for those with Grade III tumors. The same relationship was seen when the patients with and without node metastases were studied separately, although it was less striking. The incidence of metastatic lymph nodes increased with the grade of tumor.

The distribution of cases according to Dukes' classification showed a higher proportion of advanced C cases in the rectum than in the colon, with a correspondingly smaller proportion of A cases. Only 2 out of 69 cases showed node metastases before the bowel wall had been penetrated. Dukes' generalization in this regard has been shown by this series to apply to the colon as well as to the rectum. Follow-up results according to Dukes' classification showed striking differences between the A, B, and C cases. No definitely proved A case terminated fatally after operation from recurrence. The chance of five-year survival without disease was over four times as good in the A as in the C cases. The value of this classification in prognosis is obvious.

A definite relationship was found between the grade method and Dukes' method of classification. Most of the A cases were found, histologically, to be of Grade I, and very few were of Grade III, whereas C cases were for the most part of Grade III and very rarely of Grade I. The extent of spread of a tumor at operation is of the greatest importance in the prognosis in any particular case, but is in turn based primarily on the rate of growth as evidenced by the grade of the tumor. Both criteria should be used in prognosis to supplement each other. A classification combining both the grade and Dukes' method is presented.

Lymph-node metastases occurred in 27 per cent of the cases of the whole group and were twice as frequent in the rectum as in the colon. They were present in 30 per cent of the "colloid" cases, occurring in 50 per cent of those of the signet-ring type and in 18 per cent of the other "colloid" cases. The incidence of five-year survival was two and one-half times higher when the nodes were not involved than when they were. Tumors classed by gross examination as "projecting" gave far better five-year results than those classed as "infiltrating." Most of the projecting tumors were, histologically, of Grade I, and the infiltrating were of Grade III.

Variations in the histological grade in different parts of the same tumor were frequent. The grade of the tumor in the metastatic nodes was usually the same as that found in the main tumor. In 78 per cent of the 76 rectal tumors in which biopsies were taken, the biopsy showed the same grade as the tumor. In 22 per cent of the cases, the biopsy was

at least one grade less malignant. In no case was it more malignant.

The presence of enlarged lymph nodes is not a reliable indication of metastases. Of 97 cases in which the nodes were reported enlarged, only 38 per cent had metastases. No relationship could be found between the age of the patients and the five-year results.

The follow-up results which included operative deaths, cases lost to follow-up, and deaths from other causes, showed that 29 per cent of the patients in the combined group, 32 per cent of those with carcinoma of the colon, and 25 per cent of those with carcinoma of the rectum had been alive for five years without disease. Of the 17 "colloid" cases, not including the signet-ring type, 24 per cent survived five years without evidence of disease, as compared to 30 per cent of the 10 signet-ring cases. Both series, however, are too small to warrant conclusions. Thirty-four per cent of the patients with node metastases and 16 per cent of those without node metastases in the combined colon and rectum group survived five years without evidence of disease. If the nodes show metastases, the prognosis for five-year survival in cases of carcinoma both of the colon and of the rectum is just about one-half as good.

The author concludes that the grading of colon and rectal tumors is of definite value for prognosis. It is of less value, however, than the classification of these tumors according to their extent of spread, as outlined by Dukes. A combination of these two methods may prove even more effective.

SAMUEL H. KLEIN, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Stewart, J. D.: Prothrombin Deficiency and the Effects of Vitamin K in Obstructive Jaundice and Biliary Fistula. *Ann. Surg.*, 1939, 109: 588.

The author reports the results obtained in 13 patients, of whom 12 had obstructive jaundice of varying degrees from liver damage, and were given Vitamin-K-cholic-acid mixture pre-operatively. Plasma concentrations of prothrombin and bilirubin were determined. The average increase in plasma prothrombin under Vitamin-K therapy was 32.8 per cent. The average duration of treatment was three and nine-tenths days, with an average dose of 6.8 gm. The Vitamin-K extract was prepared from fresh spinach, according to the method of Dam.

The plasma prothrombin concentration in 5 patients suffering from massive postoperative hemorrhage is given. In 3 of these, the Vitamin-K-cholic-acid mixture was given immediately and the bleeding ceased, with a dramatic rise in plasma prothrombin. One patient developed severe diarrhea when the mixture was given through a jejunostomy and the bleeding was uncontrolled. In another patient, given the Vitamin-K-cholic-acid mixture through a jejunostomy, there resulted a restoration of the plasma prothrombin and a control of the bleeding tendency. The author noted that in only 1 patient observed, in whom there was obstruction of the bile flow for more than a week, was there an associated plasma concentration level of less than 84 per cent. In this 1 case the patient's appetite remained good and the biliary obstruction was incomplete. There was a drop of from 20 to 40 per cent in plasma prothrombin concentration immediately after operation. This fall was only transitory if Vitamin-K-cholic-acid feeding was resumed immediately. It was stated that a safe pre-operative plasma prothrombin level should preferably be above 75 per cent. Since these levels change frequently, determinations should be made often and early during the postoperative period. There were 2 patients who refused to take the Vitamin-K-cholic-acid mixture by mouth because it gave them epigastric distress; after a consequent massive hemorrhage, they cooperated by taking the mixture, with a resulting rapid restoration of plasma prothrombin levels to normal and cessation of bleeding.

The author raises the question of the influence of infection on plasma prothrombin. He noted that the plasma prothrombin level fell, whereas the plasma fibrinogen rose, in a patient who developed bilateral severe pneumonia while receiving Vitamin-K-cholic-acid therapy for severe hemorrhage. Likewise, he noted that there was only a 6 per cent increase in the plasma prothrombin in an adult patient following a transfusion of 600 c.cm. of blood.

ROBERT ZOLLINGER, M.D

Leinati, F.: Gangrene of the Round Ligament of the Liver (Sulla gangrena del legamento rotondo del fegato). *Clin. chir.*, 1939, 15: 253.

Leinati describes the case of a woman, aged sixty-seven years, who suddenly developed severe pain over the entire abdomen, accompanied by vomiting. She had frequently suffered from less severe attacks which were relieved in a few hours by hot applications. On admission, a diagnosis of peritonitis, probably due to perforating appendicitis, was made, but exploration showed the appendix and the adnexa to be normal. Prolongation of the incision upward revealed a thick cord running from the umbilicus to the hilus of the liver; its color changed from pinkish gray due to hemorrhagic infiltration close to the umbilicus to dark red, then dark brown and black with greenish patches typical of gangrene. It was removed between two ligatures. Examination of the biliary tract revealed extensive cholecystitis and several calculi, one of which was the size of a nut. Cholecystotomy was performed and the calculi were removed. Convalescence was uneventful. Histological examination of the removed cord showed practically total necrosis of the part in which the changes were most advanced, and zones of fatty necrosis surrounded by granulation tissue, which was in a more or less advanced stage of necrobiosis in the less altered parts; even the part close to the umbilicus presented extensive necrosis of the various elements forming the cord, but especially lipo-

necrosis. Hemorrhage, mostly recent, was found all through the cord.

This was consequently a case of gangrene of the round ligament of the liver, the nature of which is not easy to explain. Cases of pathology of this ligament in the literature are scarce: excluding vascular changes occurring in cases of cirrhosis of the liver, and abnormal permeability of the umbilical vein, the literature reports only 5 cases of cyst; 9 cases of sclerosis with retraction; 8 cases in which the round ligament was found in an epigastric hernia; 1 case of internal hernia through the falciform ligament; and 1 case of the presence of a needle which had migrated into the cord fifteen years previously. Only 1 of the cysts was of parasitic nature (echinococcus). The cases of fibrous retraction are of particular interest because they cause a syndrome characterized by postprandial gastric pain with acid eructations, and epigastric oppression or pain on palpation above the umbilicus. Hiccup has also been mentioned, but does not seem to be characteristic of involvement of the round ligament. It was not present in the author's case. The occurrence of the syndrome of para-umbilical pain with or without vomiting, always of short duration, over a number of years and at decreasing intervals of time, recalls intermittent but progressive lesions of the round ligament which finally caused gangrene and peritonitis. The absence of young or adult connective-tissue formation and the presence of extensive fatty necrosis in all parts of the cord suggest the hypothesis of a liponecrosis of the part with gradually more frequent and more severe attacks which resulted in total gangrene through extensive thrombosis of the vessels. The liponecrosis may have arisen through the irritation caused by the biliary lithiasis and the dilatation of the gall bladder. The fact that after an acute abdominal syndrome lasting about twenty hours no peritonitis was found and that consequently there was no infectious process militates in favor of the concept that the gangrene was caused by thrombosis of the principal vessels which was induced by extension of the liponecrotic process.

RICHARD KEMEL, M.D.

Brooks, B., and Wyatt, T. E.: Surgery of the Gall Bladder. *Ann. Surg.*, 1939, 109: 334.

A detailed history of the origin and progress of the surgical treatment of cholelithiasis is presented. This is followed by a discussion of the 512 operations performed on the gall bladder and bile ducts over a period of twelve years in the Vanderbilt University Hospital.

Acute cholecystitis has been treated conservatively with only 15 operations performed on the day of admission. The authors believe there is little evidence in favor of emergency operations for acute cholecystitis because of the fear of development of gangrene or peritonitis.

A right paramedian incision was used routinely and the majority of cases were drained with a small cigarette drain. There was a mortality of 2.5 per cent.

There were 31 cholecystostomies for disease limited to the gall bladder with 4 deaths. The authors report a relatively low incidence of common-duct stone, with only 29 operations performed for stones in the common duct. They recommend closure of the common duct with a rubber tube anchored to the region of closure. The mortality in the cases of stone in the common duct was 17.2 per cent.

The results in all the cases operated upon except 38 were determined from letters or personal interviews, which made the ultimate results available in 92.6 per cent of the cases from one to twelve years after operation. Seventy-five per cent of the patients having cholecystectomies for inflammatory disease limited to the gall bladder were completely relieved of all symptoms. It appeared that the results were better in patients having advanced pathological changes in the gall-bladder wall than in those with little pathological change. A somewhat larger proportion of the patients operated upon within three years reported themselves entirely well, as compared to those who had been operated upon for a longer period.

It was emphasized that the mortality from operations on the gall bladder has been changed but little in the past forty years. ROBERT ZOLLINGER, M.D.

Eliason, E. L., and North, J. P.: Morbidity Following Cholecystectomy. *Ann. Surg.*, 1939, 109: 580.

The authors present a study of the end-results obtained in 264 patients (available from a series of 504) who had undergone cholecystectomy. It was found that cholecystectomy gave relief in 94 per cent of the patients whose cases were followed up. The failures were discussed in 4 groups.

In the first group there were 8 patients in whom an incorrect diagnosis of gall-bladder disease had been made pre-operatively. Although these cases had been studied very carefully, cholecystectomy was believed to be indicated. None of the patients was benefited because the principal lesion was outside of the gall bladder, although several were found to have calculi and pericholecystic adhesions. One of the patients in this group, after two years, developed a huge carcinoma of the greater curvature of the stomach; another had pylorospasms; a third patient had acute serositis of the hepatic capsule and adjoining peritoneum with filmy adhesions, as the result of a gonococcal infection originating in the pelvis. A brief abstract of the 8 failures is presented.

Eight patients were placed in a group classified as having had incomplete diagnosis. These patients had definite cholecystic disease which was verified at operation, but, in addition, other pathology was found to be responsible for their symptoms. None of the unsatisfactory results in this group was due to undiscovered stones in the duct, despite the fact that only 18 per cent of the total number of operations for inflammatory disease included exploration of the common duct. The failures in this group were

due to the fact that the patient's suggestive symptoms were thought attributable to the gall bladder, when in reality the gall stones were silent and not the chief source of the discomfort.

Fifteen per cent of the cholecystectomies were performed for chronic, non-calculous cholecystitis.

There was a third group of 5 patients who were not relieved of their symptoms until from six to sixteen months after cholecystectomy had been performed. The authors concluded that probably relief was not obtained in these cases until the ducts had had an opportunity to dilate and, perhaps, assume the function of the absent gall bladder.

There was a fourth group of so-called extraneous complications which were not biliary in origin and which gave residual difficulty after operation. These were listed as right-sided ureteral colic; ulcerative colitis with epigastric pain; pulmonary and intestinal tuberculosis with dyspepsia; tabes dorsalis with epigastric pain; subacromial bursitis of the right shoulder; hyperthyroidism; and myocardial disease with fibrillation. The latter two were present both before and after the gall-bladder operation.

This follow-up study did not include any of the patients who had had cholecystostomy.

ROBERT ZOLLINGER, M.D.

Dick, J. C.: Carcinoma of the Lower End of the Common Bile Duct. *Brit. J. Surg.*, 1939, 26: 757.

Investigations as to the typical features of cancer at the lower end of the common bile duct are becoming of increasing importance, and in recent years attempts at surgical removal of the cancer have been made with considerable success. The author's report, comprising 13 cases, gives the main characteristics of carcinoma in this situation, and at the same time shows how hopeful the field is for the surgeon.

An analysis of 4,239 consecutive autopsies performed in the Glasgow Royal Infirmary shows that cancer of the gall bladder had occurred 20 times, cancer of the biliary tract 18 times, and cancer of the ampulla of Vater, 6 times. Altogether, these cases represented but 1 per cent of all the autopsies, yet the 18 cases of carcinoma of the bile ducts in 4,239 autopsies (0.42 per cent) showed that cancer in these passages is not so rare as is generally believed. Interesting facts were shown by an analysis of the numbers of cases with gall stones: 18 of 20 cancers of the gall bladder presented calculi, whereas only 2 of the 18 cancers of the bile ducts were associated with stones in the gall bladder or bile ducts. The sex incidence also differed greatly in carcinomas of these situations. There were more than twice as many cases of cancer of the gall bladder in women as in men, whereas bile-duct cancer occurred only slightly more often in men than in women. In the majority of patients, the condition made its appearance between the ages of fifty and sixty-nine years.

The majority of the author's cases of cancer of the lower end of the common bile duct presented a similar macroscopical picture. The tumor was situated within the lower 2 cm. of the duct. Above the growth there was marked dilatation and sacculation, with deep bile-staining of the wall of the duct. The dilatation extended back into the hepatic ducts and the small bile ducts within the liver. In a few instances, suppurative cholangitis was superadded. The cystic duct and the gall bladder were also dilated. At the lower end of the common bile duct, the tumor caused stenosis amounting to almost complete obstruction. The tumor was usually very small in extent and might easily have been mistaken for cicatricial contraction after ulceration, following the passage of a gall stone. Local extension and secondary growths in this type of cancer were unusual—a fact that has attracted the attention of others and has proved to be one of the chief indications for the attempt at surgical removal when this condition is suspected. Histologically, most of these tumors were adenocarcinomas.

Various suggestions as to the cause of carcinoma in the bile ducts have been advanced:

1. Carcinoma develops on a simple papilloma in this region, as it is known to occur in other regions; e.g., in the intestine or in the bladder.

2. Mayo-Robson thought that gall stones were a more important factor. Ewing also suggested that the trauma due to calculi might be one of the causes. Most other observers, however, have shown that gall stones are not frequently present in such cases, in contradistinction to cancer of the gall bladder. The present series also discredits the importance of gall stones as a causative factor in carcinoma of the bile ducts.

3. Rolleston was of the opinion that carcinoma might arise on an old ulcer in this situation, as in gastric carcinoma. However, the author does not find this to be true.

JOSEPH K. NARAT, M.D.

Pavlovsky, A.: The Treatment of Acute Pancreatitis (Discusión actual del tratamiento de las pancreatitis agudas). *Bol. Soc. de cirug. de Buenos Aires*, 1939 (10, 5).

The high operative mortality of acute hemorrhagic pancreatitis has induced many authors to investigate the cause of this condition. Pavlovsky thinks that today there is a tendency to use the same treatment for the many different types of acute pancreatitis. Some authors consider operation the treatment of choice, while others do not favor operation; a certain amount of confusion exists on this point.

Pancreatitis may be classified as follows: (1) classic, acute hemorrhagic pancreatitis, (2) acute edema of the pancreas with all of its variations, and (3) serous hemorrhagic apoplexy of the pancreas.

1. The clinical symptoms of acute hemorrhagic pancreatitis are classic. Operation shows cytosteatonecrosis of the gland, the peritoneum, and the omentum. In addition, there is a hematoma or hemorrhage and often acute distention of the biliary ducts associated with a gall bladder filled with stones.

Pavlovsky believes that the condition in all cases in this group can be improved by operation and that in none will it show improvement following non-operative measures. Surgery consists chiefly of relief of the tension of the biliary tract by means of cholecystostomy and drainage of the necrotic focus in the pancreas. The author concludes that only operative measures can give any hope of success, even if the rate of mortality is very high.

2. Acute edema of the pancreas has received the attention of many authors in recent years. The author believes that, as the condition does not always precede acute hemorrhagic pancreatitis, the treatment may be non-operative and should be as energetic as possible. In this way, emergency operations with all their dangers can be avoided. If we study the clinical records of many patients with acute biliary colic, we very often find that during the attacks there is abdominal pain with irradiation to the back, as well as a certain degree of peripheric shock. These symptoms show the involvement of the pancreas and indicate the urgency of an operation designed to correct the biliary disease.

Medical treatment consists of the injection of hypertonic saline or hypertonic glucose solution, the administration of cardiac tonics, adrenaline or ephetonine, caffeine, or camphor derivatives, and, in serious cases, blood transfusions.

Recovery is very slow, often requiring two or three days, but the best procedure is to wait and operate later, when the patient is in better condition.

The author states that early operation in acute edematous pancreatitis has given poor results, as the mortality is around 50 per cent. Some authors believe that operation should be avoided in every case as the distinction between edematous and hemorrhagic pancreatitis is quite difficult. The statistical results are very different, the mortality ranging from 0 to 22 per cent.

The distinction between the two kinds of pancreatitis can be made through observation of the symptoms, especially at an early stage of the condition; if energetic clinical treatment gives no success, the hemorrhagic form is suggested. The alarming symptoms of edematous pancreatitis, very often complicated by hepatic colic, respond slowly to medical treatment. On the other hand, the persistence of a serious condition indicates the possibility of a hemorrhagic pancreatitis. Chemical examinations give modifications of the normal values in both forms.

3. Serous hemorrhagic apoplexy of the pancreas. According to the new concepts of Gregoire, Silvestri, and others, acute pancreatitis is the result of a general disturbance with special emphasis on the pancreas, depending on local conditions. Hemorrhagic congestion is produced through excitation of the splanchnic nerve. Visceral hemorrhage is the consequence of a circulatory change, produced by disturbances of the neurovegetative system. The lesion may be chemical or physical; the important thing is the involvement of the vasomotor centers.

Many cases in which the classical picture of acute hemorrhagic pancreatitis was the cause of death did not reveal any lesion of the biliary tract. The only explanation which could be given was the existence of neurovegetative lesions. Sometimes the difficulty was in the liver; if the hepatic cells failed in their function, the liver could not prevent severe shock, and the pancreas was the site of a congestive hemorrhage, caused by the suppression of essential functions of the liver.

The symptoms are extreme epigastric pain, peripheric collapse, descent of the blood pressure, and, in contradistinction to hemorrhagic pancreatitis, a very marked resistance of the abdominal wall.

Operation shows an infiltrating edema of varied extension, including the gland and the depending omentum. Stains of cytosteatonecrosis are exceptional. The biliary tract seldom presents lesions.

Treatment must be very energetic: adrenaline must be given to combat shock and hepatic insufficiency must be overcome.

Gregoire and Couvelaire think that operation must be performed for the following reasons: diagnosis is never certain, medical treatment very seldom gives relief from pain, and the pancreas must be explored because of the possibility of a necrotic focus which may need a special type of drainage.

HECTOR MARINO, M.D.

MISCELLANEOUS

Gutierrez, A.: Drainage of the Abdominal Cavity (Del drenado de la cavidad abdominal). *Rev. de cirug. de Buenos Aires*, 1938, p. 610.

The lack of asepsis and imperfections of technique were the reasons that made surgeons advocate abdominal drainage very strongly. However, with the perfection of operative technique, we see the first reaction against this practice, and today abdominal drainage is very restricted.

The author divides drainage into two types: preventive and obligatory. Preventive drainage is done when the operation is finished and there are doubts about a suture, or a hemorrhage is feared.

As for the methods employed to increase the defenses of the peritoneum, the author thinks that none is successful.

Gutierrez advocates short drainage after surgery of the bile duct and uses a rubber tube or a strip of gauze. After a cholecystectomy he prefers a thin rubber tube, placed near the stump of the cystic duct, which is left in place from twenty-four to forty-eight hours.

Whenever the bed of the gall bladder has not been covered, he leaves a narrow strip of gauze. In some cases he has seen a small quantity of bile discharging from the drain.

In all infected cases he drains the common duct; as soon as the bile comes out clean, he tyndallizes it and gives it back to the patient.

Usually he does not leave any drain after gastric surgery; but if there is any doubt about the closure

of the duodenal stump he leaves a rubber tube as a measure of prevention.

In acute appendicitis he never employs a drain if the appendix is intact; in the case of a gangrenous appendix he leaves a tube. If there is diffuse peritonitis he always employs a drain.

The author does not agree with Ombrédanne who closes the abdomen in all acute cases, as he has seen many deaths caused by this procedure.

In gynecological surgery he employs drainage only exceptionally; usually he uses a piece of rubber tubing, sometimes a narrow strip of gauze. He has found drainage according to Mikulicz to be bad practice.

For drainage of the pouch of Douglas and for drainage of the pelvis after total hysterectomy he uses a piece of rubber tubing.

HECTOR MARINO, M.D.

Desjardins, A. U.: Retroperitoneal Lymph Nodes: Their Importance in Cases of Malignant Tumors. *Arch. Surg.*, 1939, 38: 714.

In view of the fact that malignant tumors may metastasize through the lymphatic channels or spread from one group of lymph nodes to another along the lymphatic channels, the retroperitoneal nodes are the most important lymph nodes in the body. Because of their relative inaccessibility little attention has been given to them and the relation between certain clinical symptoms and physical signs and the pathological involvement of this group of nodes is often overlooked.

Carcinoma of the bladder, prostate, uterus, or rectum often extends backward and causes dull pain in the sacral region. In addition, symptoms caused by extension of the tumor beyond the organ primarily affected may be backache, pain in the abdomen, bloating, belching, enlargement of the abdomen, and constipation. With dull backache without evidence of skeletal metastasis, pain most probably is due to metastasis of the tumor to the abdominal lymph nodes. Abdominal pain and fullness after eating, accompanied by other symptoms mentioned, vary and often cause the patient to undergo surgical resection of other organs. The physical signs are sometimes not clear, but careful palpation will disclose a sense of deep resistance of the affected group of nodes, accompanied by slight or moderate tenderness.

Malignant neoplasms of the testis and ovary, save in those cases in which rupture of the capsule in the former has produced superficial inguinal metastasis or in which peritoneal implantation of malignant cells of the latter has caused ascites, metastasize directly into the upper para-aortic nodes and produce symptoms and physical signs as mentioned previously.

Involvement of these nodes is still more important in lymphoblastoma (Hodgkin's disease or lymphosarcoma). It is generally taken for granted that this variety of tumor always begins in the cervical nodes and thence extends to other groups of nodes. This is far from true. In a considerable proportion of cases the malignant process first affects the retroperitoneal nodes and gradually spreads to the nodes in other regions. Almost invariably the retroperitoneal nodes are involved sooner or later regardless of the site of initial involvement.

The onset of symptoms is usually insidious; pain often is either absent or moderate, inconstant or interrupted by more or less prolonged remissions, so that many patients have distress for months or years before seeking to know the cause and have it removed. Unfortunately, the frequency of primary or secondary involvement of the para-aortic or mesenteric nodes is so seldom realized that the factors responsible for the patient's symptoms go unrecognized for a long time. A striking feature is the great variety of the symptoms, and this, perhaps more than anything else, accounts for the difficulty which those who have not examined and followed a large number of patients with the disease have in recognizing the character and the cause of the patient's difficulties. One patient may complain wholly of impairment of vision, thickening of the lids, or bulging of the periocular tissues; another may complain of pain in one of the abdominal quadrants and may already have undergone cholecystectomy or appendectomy with only temporary relief; another patient's chief complaint may be itching, which, having been confined for a time to the lower or upper extremities, has gradually extended to the entire body and has become so severe that restful sleep has become impossible; the principal difficulty of another patient may be pain in the back which extends to one or both lower extremities; another may have as his chief symptom an "afternoon fever," which may be continuous or may occur in intermittent waves; another may suffer mainly from pain in the "stomach," which occurs from a half to three hours after meals; the chief complaint of another may be loss of weight; another may complain of amenorrhea. And yet all these patients may be suffering from Hodgkin's disease or lymphosarcoma, which affects the retroperitoneal nodes only or affects groups of nodes in other regions as well.

Because of the great variation in the symptoms and the protean complications which may develop during their course, Hodgkin's disease and lymphosarcoma can simulate many diseases. So true is this that, as experience accumulates, an increasing proportion of the baffling diagnostic problems prove to be lymphoblastoma, and in many such cases the malignant process has originated in the retroperitoneal nodes. The diagnosis can be made without biopsy in a large percentage of cases. Indeed, an excised node may not display the typical findings to enable the pathologist to make a positive diagnosis and the condition may be reported as inflammation or as a highly undifferentiated carcinoma.

A feature of lymphoblastomatous involvement of the retroperitoneal nodes is the variation of symptoms from time to time. In relation to its importance, too much attention is given to peripheral

adenopathy, since only occasionally does this impair the general well-being of the patient. Perhaps the most common symptom mentioned by patients is loss of strength. Weight may be maintained for a long period of time, but in a significant proportion of cases rapid loss may take place. Peripheral lymphadenopathy is rarely accompanied by pain, but varying degrees of abdominal discomfort occur with retroperitoneal or intra-abdominal lymphoblastoma. These symptoms may simulate any of the diseases commonly associated with the digestive tract; often surgical procedures are instituted with at best temporary relief. Backache is undoubtedly caused by the increased pressure of enlarging para-aortic nodes on nerves of the lumbosacral plexus. This may vary from a tired feeling in the back to sharp pain. Hasty diagnoses in these cases when minimal or co-existing arthritic changes are seen on roentgenograms may lead one astray. Treatment of pain in the lower extremities in the presence of lymphoblastoma should be directed to the lumbar region. Bloating, belching, a sense of "filling up easily" with or without pain, nausea, and vomiting may originate from retroperitoneal masses.

The occurrence of fever with retroperitoneal or mediastinal lymphoblastoma is almost constant, particularly with the former. There is proof from experience that irradiation of abdominal fields in lymphoblastoma will cause the fever to abate, which yields the apparent conclusion that involvement of abdominal and retroperitoneal nodes causes fever in this disease. In obscure fevers, a therapeutic test of this type is warranted. As with fever, pruritus and cutaneous lesions are associated with retroperitoneal lymphoblastoma, with the possible exception of certain mediastinal lymphadenopathies.

Skin pigmentation, constipation, diarrhea (caused by involvement of lymphoid follicles of the intestinal mucosa), edema, ascites, jaundice, and symptoms referable to the urinary tract and pelvic organs occur. None of these or previously described symptoms can be taken as pathognomonic of abdominal lymphoblastoma alone, but when the history points to a gradual increase in any of them, with or without variations, the possibility must be entertained. When enlarged peripheral nodes occur, this possibility becomes a probability.

Certain physical signs are usually present when abdominal lymphoblastoma has progressed far enough to produce symptoms. They go unrecognized too often because the frequency of lymphoblastoma is not realized and because few physicians have learned how to examine the abdomen for malignant invasion of the retroperitoneal nodes. To examine the abdomen of a patient for metastasis to the nodes of this region with some chance of obtaining maximal information, certain conditions must be present.

With the patient recumbent, the head should be slightly flexed, the thighs also should be brought toward the trunk, with the upper extremities at rest along the body. When the para-aortic nodes are affected by lymphoblastoma and have attained a large size, they are sometimes readily felt as nodular masses in the epigastric region. Sometimes palpable masses are scattered throughout the abdomen. In the majority of cases, definite masses cannot be felt. This is why the average physician so often fails to recognize the physical signs of such involvement. When pressure on the anterior abdominal wall is made, the examiner's hand feels in the upper half or upper two-thirds of the abdomen a deep resistance which is abnormal. Many recognize this and do not realize its significance, ascribing it to muscular rigidity. The sensation of solidity may vary considerably. The other sign is tenderness. This is not severe, but very definite. Often the patient's attention must be drawn to it; at other times he will wince noticeably. Tenderness in the absence of deep resistance should suggest the condition.

Special methods of examination, as proctoscopic or vaginal examinations, frequently disclose direct involvement of pelvic organs or secondary pressure and changes of position caused by lymphoblastomatous involvement.

In the great majority of cases, roentgenological examination of patients with retroperitoneal or abdominal lymphoblastoma does not yield any evidence of abnormality. However, extrinsic pressure changes are not uncommon. Occasionally gastric involvement is mistaken for carcinoma. Bones may show changes as a result of extrinsic pressure, and at times urographic roentgenograms disclose evidence of similar changes.

GYNECOLOGY

UTERUS

Tyrone, C. H.: Complete Tears of the Perineum. Preparation, Operative Technique, and Treatment After Operation. *Surgery*, 1939, 5: 653.

The author reviews the cases of 63 patients who were operated upon for complete tear of the perineum. Perfect control of the anal sphincter was obtained in 49 (86 per cent) of the patients, and partial control in 7. There were but 2 failures.

Success in obtaining perfect results is dependent upon the preparation, the choice of operative procedure, and, to a great extent, upon the treatment following operation. In order to provide complete restoration of the lost sphincter control, the procedure chosen should be the one that is best adapted to the extent of damage of the structures.

Regardless of the technique that is followed, the following precautions should be observed: (1) free dissection and excision of all scar tissue; (2) the insertion of sutures to allow for swelling and to guarantee freedom from tension along the suture line; and (3) the avoidance of dead spaces.

Following the operation, treatment should be such as to make certain there will be no movement of the bowel for at least seven days, or until healing is effected. The perineal region must be kept as nearly sterile as possible and, at the same time, the traumatizing effects of enemas, douches, and rectal tubes must be carefully avoided.

CHARLES BARON, M.D.

Kotz, J., and Parker, E.: The Clinical Interpretation of the Endometrial Biopsy. *Endocrinology*, 1939, 24: 447.

This paper is based on endometrial biopsies from 300 patients who apparently were suffering from ovarian dysfunction. They complained of amenorrhea, menorrhagia, metrorrhagia, menopausal symptoms, sterility, and dysmenorrhea. A specimen of endometrium was obtained two or three days before the expected onset of a menstrual period. When there were marked menstrual irregularities, the biopsy was taken in from twenty-two to twenty-six days after the last period; if menstruation did not occur within from five to seven days thereafter, the biopsy was repeated until one was obtained just prior to the flow. In cases of amenorrhea and prolonged bleeding, a biopsy was taken every week for several weeks, and the specimen showing the most growth and differentiation was used. *Unless due consideration is given to the time relation of the biopsy to adjacent periods of bleeding, a study of endometrial biopsies is of little value.*

The endometrium does not respond as a whole to hormonal stimulation. The mucosa in the fundus shows the most marked development, and that near the cervix may show little or no reaction. Therefore, these biopsies were obtained with a suction curette by making four downward strokes from the fundus.

An endometrium, to be diagnosed as pathological, may vary from the normal in two ways. The histology of the phase may be normal, but the time of its occurrence in the cycle does not conform to the normal; on the other hand, the structure of the endometrium may be pathological. The following endometrial patterns were recognized:

Atrophic follicular. Only fragments of epithelium were obtained for biopsy. The tissue consists of a loose stroma in which a few small follicular glands are present.

Such endometrium represents the most profound type of ovarian failure: not only is there an absence of corpus-luteum function, but there is also a failure of follicular hormone. This type of endometrium is always encountered after a cessation of menstrual function.

Persistent follicular. The development of the endometrium is not as advanced as it should be for the time at which the biopsy is taken: the follicular reaction is still present when under normal conditions there is luteal differentiation.

Hyperplastic follicular. The glands are increased in number and vary considerably in size, shape, and distribution. There is an increase in the number of cells of the glands, which leads to an increase in the thickness and an infolding of the epithelium, which often results in islands of epithelium within the gland lumen. Mitoses are frequent.

Cystic follicular. The glands show marked irregularity in size and shape: many are dilated to the point of cyst formation. The stroma is dense. This is the Swiss-cheese endometrium.

Delayed postovulatory. The authors look upon subnuclear vacuolization as a characteristic feature of the postovulatory phase. They believe that subnuclear vacuolization occurs within from twenty-four to seventy-two hours after ovulation. They observed this phenomenon as early as the sixteenth day of the cycle and as late as the sixtieth day.

Normal secretory. Normal secretory endometrium can be developed even after four months of amenorrhea. Bleeding may occur from endometria exhibiting varying degrees of secretory differentiation. However, once a secretory reaction has developed, uterine bleeding always follows shortly thereafter.

Loose or spongy secretory. The stroma remains loose and spongy. The epithelial cells never attain a high columnar type, or show secretory activity. The glands appear tubular, with marked dilatation of the lumen. This endometrium gives the impression of a persistence of the hormonal balance which is considered characteristic of the earliest part of the secretory phase.

Mixed. This term denotes the simultaneous occurrence of follicular and luteal characteristics. A

certain degree of mixture is physiological and consequently this diagnosis is made only when the general endometrial pattern is a mixture of the two types. In most cases with a mixed pattern, other abnormalities also were present; e.g., incomplete secretory reaction, hyperplasia, and cysts.

Glandular hyperplasia in the luteal phase. The glands were larger than normal, with excessive proliferation of the epithelium which resulted in rather bizarre infolding of the epithelium. The secretory reaction was less than normal. The stroma was dense.

Glandular hypoplasia in the luteal phase. There are two types. In one type, the glands may be few in number, small in size, and may show very little secretory reaction; the stroma is midway between follicular and secretory, and cysts are common. In the second type, glands are of normal number, but small; proliferation and secretory differentiation both appear to be deficient.

Cystic endometrium. Cystic dilatation of the glands was found in every type of endometrium; this abnormality, *per se*, is of little practical importance.

In attempting to correlate the biopsy findings with clinical symptoms, the authors conclude that there are no specific endometrial patterns for the various menstrual disorders. Amenorrhea is a possible exception; here the endometrium is usually in a stage of follicular arrest, or atrophy. Specific changes are not demonstrable in the menopause, but the endometrium merely reflects the degree of ovarian failure. Oligomenorrhea and polymenorrhea occurred with practically every type of endometrium. The occurrence of bleeding from all types of endometrium suggests that another element, the bleeding factor, is a necessary activator of the bleeding phase of the menstrual cycle.

The ovarian-endometrial cycle is a labile phenomenon in which a definite sequence of events normally occurs, but to which specific time limits cannot be attached. Any disturbance in the normal balance of ovarian hormones is reflected in the structure of the endometrium. Consequently, the endometrial biopsy is the most efficient and the simplest method of determining ovarian function.

GEORGE H. GARDNER, M.D.

Mikulicz-Radecki, F. von: The Treatment of Cervical Carcinoma in the Koenigsberger University Women's Clinic in the Years from 1910 to 1937. *Strahlentherapie*, 1938, 63: 414.

The article contains three complete statistical surveys on cervical carcinoma covering the years from 1910 to 1918, 1919 to 1925, and 1925 to 1932. These divisions are made in accordance with the activities of Winter and Zangemeister as directors of the Clinic. Up to 1925, treatment of cervical carcinoma in this clinic was chiefly operative (from 1910 to 1918, 52 per cent operative and from 1919 to 1925, 26 per cent operative). The operated cases included carcinoma in Stages 1 and 2. In the first of these two periods the relative cure of the operated cases was about 25 per cent; in the second period it was increased to 30 per cent by total vaginal extirpation and decreased to 17 per cent by the Wertheim operation. In the latter period radiation treatment was becoming more important; it had produced cures in 21 per cent of cases in Stages 1 and 2, but only in 5 per cent of those in Stages 3 and 4. In the third period (1925–1932) Zangemeister and Wieloch found the operable cases in Stages 1 and 2 to amount to 46 per cent but only 9 per cent were operated upon. The relative cure of these cases which were operated upon was 53 per cent, which in contrast to the earlier periods was very good. Radiation treatment also showed considerable advance; of the operable cases treated by irradiation 34 per cent were cured. However, intensive irradiation, especially with radium, caused a large number of radium injuries, particularly of the rectum.

The author adds a summary of his own cases of cervical carcinoma for the years from 1932 to 1937. Of these he operated 34 per cent with a primary mortality of 4.4 per cent and irradiated the rest with a primary mortality of 3 per cent. Since in these cases the longest observation period offered is five years, only the year 1932 can be considered. The cases of this year present the following results:

Of 7 cases in Group I, 6 were operated upon and 1 was irradiated; all were cured. Of 18 cases in Group II, 6 were cured by operation and 12 terminated fatally, on the average, after one and one-half years. Twenty-four cases in Group III were irradiated only; only 2 patients are still living; the rest died, on the average after two and one-half years. One case in Group IV was not influenced by irradiation. The summary, therefore, does not give a clear picture of the probable cures for this clinic.

The author favors operation as the most promising procedure in the cure of cervical carcinoma and also gives the technique of a combined radium and roentgen irradiation method for cases which are no longer operable. (F. SIEGERT). RONALD R. GREENE, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Cotte, G., and Mathieu, J.: Ovarian Endometriosis (L'endométriose ovarienne). *Gynéc. et obst.*, 1939, 39: 81.

Cotte and Mathieu note that in a series of 78 cases of endometriosis recently reported, they found 22 in which the ovary was involved. Since that time they have had another case of ovarian endometriosis, which brings the total number of cases studied to 23. The ovary alone was involved in 8 of these 23 cases, the ovary and the uterus in 7 cases, the ovary and the peritoneum in 3 cases, and there was diffuse endometriosis with ovarian involvement in 5 cases.

Ovarian endometriosis may produce acute symptoms of bleeding and collapse simulating tubal pregnancy. Only 1 of the authors' cases was of this type. Dysmenorrhea is the most characteristic symptom of ovarian endometriosis; it was the chief symptom in 12 of the authors' 23 cases and in some cases it was

very severe. In some cases dysmenorrhea is the only symptom, but is more frequently associated with intermenstrual pain, pollakiuria, or intestinal symptoms. In such cases the symptoms and the palpable tumors simulate cystic ovaritis. In 1 case the symptoms and the presence of an adnexal mass simulated salpingitis. In cases in which ovarian endometriosis is associated with endometriosis of the uterus, of other organs, or of the peritoneum, symptoms of ovarian involvement are slight and often overlooked.

There are three anatomical types of ovarian endometriosis: the first presents an enlarged cystic ovary, with a single cyst or multiple cysts; the second presents a sclerotic ovary, little, if any, enlarged and containing small multiple cysts; and the third presents small dark nodules involving the ovary and neighboring structures, especially the pouch of Douglas and the posterior surface of the isthmus.

As the diagnosis of ovarian endometriosis often cannot be made except at operation, the authors advocate surgical treatment. In case of endometriosis involving only one ovary, removal of this ovary with conservation of the healthy ovary is indicated; if the opposite ovary is not involved at the time of operation, there is little danger of recurrence. If both ovaries are involved, both must be removed, but hysterectomy is not indicated if there is no uterine involvement. In diffuse endometriosis with ovarian involvement, bilateral castration is indicated and hysterectomy is often necessary; an exception may be made when only the peritoneum and one ovary are involved. In such cases the removal of the diseased ovary and of subperitoneal endometrial plaques is sufficient. In cases of associated uterine lesions in women over forty, hysterectomy with removal of both ovaries is usually indicated. Also in younger women with massive involvement of both ovaries and uterine fibroma, the radical operation is indicated. In cases with unilateral ovarian involvement and a uterine fibroma that can be removed easily, a conservative operation can be done. In cases of recurrence in which dysmenorrhea is the chief symptom, radiotherapy gives good results, but when there are constant symptoms not related to the menstrual period the authors prefer a hysterectomy. Radical operation was done in only 1 of the 8 cases in which the ovary alone was involved. Of the 7 cases in which conservative operation was done, 2 were recent; 1 was complicated by Hodgkin's disease; and 3 resulted in cure. Two of the last patients subsequently became pregnant. In the seventh case there was a recurrence cured by secondary hysterectomy. The radical operation was done in 5 of 7 cases with involvement of the ovary and uterus, a conservative operation in 2. One of the latter has been operated only recently; in the other case a secondary hysterectomy was necessary. In all 3 cases with involvement of the ovary and peritoneum, a conservative operation was done; in 2 the results were good; 1 case has not been followed up. A radical operation was done in all 5 cases of diffuse endometriosis with ovarian involvement. Of the 11 cases in which bilateral castration was necessary, 3 have presented severe menopausal symptoms.

ALICE M. MEYERS.

Mathieu, J.: The Prognosis of Primary Malignant Epithelial Tumors of the Ovary (Etat actuel du pronostic des tumeurs malignes épithéliales et primitives de l'ovaire). *Gynécologie*, 1939, 38: 65.

Mathieu notes that the clinical symptoms, as a rule, do not clearly indicate the prognosis in ovarian tumors. The operative findings are of greater importance. Large solid tumors, especially if showing some necrosis, indicate a poor prognosis even if there is no peritoneal involvement. In 24 cases of this type, 15 of the patients died within six months. Simple cysts, or those with few vegetations, are usually benign, although there are exceptions.

Vegetative tumors if well encapsulated are usually benign; of 43 such tumors with a fibrous capsule, only 12 showed evidence of malignancy. In 43 cases of tumors not well encapsulated, 25 ran a rapidly fatal course. In vegetative tumors, the author has found that the best histological indication of malignancy or non-malignancy is the origin of the tumor—whether from the germinative or the wolffian tissue. He was unable to identify the origin of the tumor in only 10 of 86 cases. Tumors originating in the germinative tissue are more benign than those originating in the wolffian tissue. In the author's cases, the prognosis made on this basis was wrong in only 15 per cent.

In solid epithelial tumors of the ovary, the author has been unable to determine any histological characteristics that are definitely indicative of malignancy or non-malignancy. Tumors which show a definite endocrine effect are less likely to be malignant than solid ovarian tumors in general. These include folliculomas, arrhenoblastomas, and seminomas. The author has found that folliculomas particularly are benign, 70 per cent of his patients with this type of tumor having a long survival after operation. Further study of the nature of ovarian tumors is necessary before the prognosis can be more definitely determined.

ALICE M. MEYERS.

EXTERNAL GENITALIA

Custo, E. L.: The Vaginal Mucosa in Relation to Ovarian Function (La mucosa vaginale della donna in rapporto alla funzionalità dell' ovaio). *Folia demograph. gynaec.*, 1939, 36: 57.

The author first presents a review of the literature pertaining to the relation of the vaginal mucosa to ovarian function, beginning with the first work of Morceau in 1889 to the modern studies of Dierks, Zondek, and Clauberg. He then proceeds to describe his personal studies and experience based on 30 vaginal biopsies done at various ages, during different phases of the menstrual cycle, and during different periods of the sexual life. Numerous photomicrographs and illustrations are presented of the histological appearance of the vaginal mucosa under these various conditions.

The author found that there is a cycle in the structure of the vaginal mucosa; that there are considerable individual differences as well as differences in various parts of the vagina; and that such varied factors as chemical, bacterial, and mechanical influences, as well as hemorrhage and an ambulant condition, may alter the vaginal reaction. The anatomical and functional integrity of the sexual organs is necessary for the study of the changes during the menstrual cycle. During pregnancy the vaginal epithelium hypertrophies and shows vacuolization of the basal stratum; the hypertrophy is apparent even on the sixth day of the puerperium. During the menopause the vaginal epithelium is at rest.

In a case of carcinoma of the cervix during the menopause, the vaginal mucosa was found at rest. In a fibromyoma of the uterus in a sexually functioning adult the epithelium was normal in extent but did not correspond with the phases of the menstrual cycle.

There is an extensive bibliography of the entire subject. JACOB E. KLEIN, M.D.

Foss, G. L.: Further Developments in the Treatment of Kraurosis, Leucoplakia, and Pruritus Vulvæ. *J. Obst. & Gynaec. Brit. Emp.*, 1939, 46: 271.

When the body is deprived of the follicular hormone, all tissues which are normally dependent on it for their growth and development atrophy and assume senile characteristics. The vagina, labia, and clitoris lose their elasticity and atrophy. The introitus becomes narrowed; often the vagina is constricted; and the vaginal mucosa is thin.

Other authors have shown that patients with pruritus, leucoplakia, kraurosis, and vulvovaginitis may also have an achlorhydria. Since all women suffer an estrin reduction, yet only a few develop some type of vulvovaginitis, it seems possible that hypochlorhydria or achlorhydria, together with Vitamin-A deficiency, may be of importance in the development of these inflammatory lesions.

Biopsies of the vestibule in kraurosis, and of the labia in leucoplakia, reveal that adequate treatment with large doses of estradiol completely alters the appearance of the mucosa.

Of 48 patients treated, 38 were given injections of estradiol benzoate twice weekly, and as improvement occurred the injections were reduced to once a week.

At the beginning of treatment the doses ranged from 10 to 25 mgm.; they were gradually decreased. After the introduction of efficient local treatment with ointment or suppositories and oral therapy with hydrochloric acid, the very high doses, such as 25 mgm., were not found necessary.

Local treatment was given to 42 patients in the form of ointment of different strengths of estrone, estradiol, or estradiol benzoate in various bases, and in suppositories containing estradiol. Of the patients who did not receive local treatment, one suffering from slight leucoplakia found relief from cod-liver oil and hydrochloric acid taken by mouth; another patient suffering from early kraurosis obtained benefit with the same oral treatment and implantation of estrone; and the remaining 4 patients received estrone by injections and orally.

Tablets of estrone or estradiol, in doses ranging from 13 to 120 mgm., were implanted in 15 patients, the purpose being to obtain information about the rate of absorption so that adequate dosage could be calculated for the average case. In most patients the doses used were not adequate to obtain relief without the aid of local therapy.

Very few patients obtained complete and lasting comfort, and nearly all complained of slight relapses, but they were quickly brought under control by additional local therapy or a few injections. The more severe cases need almost continuous substitution therapy in one form or another, but ordinarily suppositories or ointments maintain these patients in a fairly comfortable state.

GEORGE H. GARDNER, M.D.

MISCELLANEOUS

Novak, E.: Clinical Syndromes Referable to Failure of Ovulation. *Am. J. Obst. & Gynec.*, 1939, 37: 605.

Failure of ovulation occurs not infrequently in ostensibly normal women, and is the responsible factor of some cases of sterility and of the most frequent variety of functional bleeding.

With reference to the former problem, there is, after all, much analogy between the two sexes. The more cases of sterility the author sees, the more impressed he is with the frequency and importance of the male factor. Complete aspermia is not at all infrequent in men who otherwise seem quite normal, in whom there is no history of gonorrhea, mumps, or other infections, and in whom the genito-urinary specialist finds no evidence of infection of the prostate, or seminal vesicles. The same statement can be made as to necrospermia, which likewise is a frequent finding. That cases of anovulation in women, or cases in which defective ova lead to early and perhaps repeated abortion are of endocrine causation, probably of pituitary origin, seems certain. It is important to recognize these abnormalities of ovulation, even though further developments must be awaited before treatment offers any hope of consistent success.

The same fundamental defect, failure of ovulation, is concerned in the most common variety of functional bleeding, and likewise implies primarily a pituitary dysfunction. If one could bring about ovulation therapeutically in such cases, the problem would be attacked at its source. A promising field of investigation in the effort to find a means of promoting ovulation in non-ovulating women is the study of the effects upon the ovaries in ovulating and non-ovulating women of the gonadotropic principles found in the blood serum of pregnant mares.

EDWARD L. CORNELL, M.D.

Natale, P.: Primary Mortality and Morbidity in Gynecological Radium Therapy (Mortalità e morbilità primaria nella radiumterapia ginecologica). *Tumori*, 1939, 25: 215.

The material of Natale includes 1,587 cases of cancer of the female genitalia treated with radium at the Vittorio Emmanuele III National Institute of Milan from May 1928 to the end of 1937. Among these cases were 962 of the portio, 265 of the cervical canal, 73 of the endometrium, 120 of the vagina and vulva, and 167 recurrences. Twenty patients died within one month after termination of the treatment, giving a primary mortality of 1.26 per cent; but, as at least 5 of these died from intercurrent diseases, unrelated to the treatment, the mortality should be reduced to about 1 per cent. All authors agree that the principal and nearly only cause of death after radium treatment is of an inflammatory nature. In the present series, infection accounted for 7 deaths, cardiac insufficiency for 4, cerebral embolism and bronchopneumonia for 2 each, and anemia, glomerulonephritis, uremia, cachexia, and shock for 1 death each. The lethal infections consisted of 2 cases of parametritis, 4 cases of peritonitis and 1 case of septicemia. Infection is a frequent complication, but rarely leads to death; it is favored by the presence of a profuse bacterial flora in the carcinoma, by the rather frequent pre-existence of inflammation of the adnexa, and by the decrease in the defense powers of the vagina, and is aggravated by the destructive action of the radium and stagnation of detritus, which highly favors bacterial development. The 4 patients who died from cardiac insufficiency presented cardiac defects, but no signs of decompensation before the beginning of the treatment; the insufficiency occurred during the treatment in 3 and immediately after the treatment in 1. The 2 deaths due to cerebral embolism occurred on the third and thirteenth days after the treatment; respectively. While a direct or indirect causal relationship between the treatment and the deaths due to infection, cerebral embolism, shock, cardiac decompensation, and glomerulonephritis may be admitted, there is no doubt that this relation must be excluded in the cases of anemia, uremia, cachexia, and bronchopneumonia.

A number of complications were observed: they were serious in 191 patients, or 12.04 per cent, and slight in 633 patients, or 39.86 per cent; this left 743 cases, or 46.84 per cent, in which the course was normal. If the uterus alone is considered, there were 1,300 cases with a primary mortality of 1.31 per cent, serious complications in 171, or 13.15 per cent, and slight complications in 530, or 40.77 per cent. In the remaining 582 cases, or 44.77 per cent, the course was normal. However, it should be noted that the slight complications included even small rises of temperature, occurring for one day only, and other minimal disturbances that had practically no clinical importance. In their order of frequency, the complications, whether serious or slight, were rises of temperature not due to localized inflammation, localized infection, vesical lesions, proctitis, circulatory disturbances, hemorrhage, prostration, acute nephritis, and ulcer of the posterior fornix (1 case each of the latter 2). As complications are so very frequent, all efforts must be bent to prevent them: disinfection of the cervix is indicated in all cases; serum and vaccine therapy has been recommended, and encouraging results have been obtained at the Institute by local applications of vaccines (Bezredka's method). Preliminary roentgen treatment, the application of 1 radium tube in front of the portio for twenty-four hours, and systematic electrocoagulation have been preconized.

The radium treatment was given in one protracted stage until the dose considered necessary was reached, but the tubes were removed every other day for disinfection of the tubes and of the parts. The tubes were kept in place with gauze tampons or by moulages, according to the individual case, and contained 5 or 10 mgm. of radium element filtered with 1 mm. of platinum for the uterus and 2 mm. of platinum for the vagina, each tube being covered with non-metallic rubber. The needles contained from 1 to 3 mgm. of radium element filtered with 0.5 mm. of platinum. Various combinations of tubes were used, depending on the extent of the lesion to be treated. In order to avoid inflammatory complications, stagnations of exudates must be prevented, and the treatment eventually suspended if fever appears.

RICHARD KEMEL, M.D.

A CONSIDERATION OF THE CAUSE OF THE ONSET OF LABOR

Collective Review

D. N. DANFORTH, Ph.D., M.D., New York, New York

A. C. IVY, Ph.D., M.D., Chicago, Illinois

THE cause of the onset of labor has long been a problem of interest to both philosophers and scientists. In spite of an enormous literature upon the subject, there has been no complete explanation of the phenomenon. Within recent months, isolated fields have contributed significant data which bear upon the subject. Also, much progress has been made by those primarily interested in this question. This report is submitted in the hope that the material which is here presented may serve to correlate this evidence in such a manner that it may prove of value in the ultimate solution of the problem.

At the outset, one should remember that a theory for the onset of labor should be capable not only of explaining the spontaneous onset of labor at term, but also of being fitted to those instances in which labor is artificially induced or suddenly precipitated in women not at term.

In reviewing this literature in the light of our present knowledge, the following subjects should be discussed:

I. The rôle of nervous mechanisms
II. The present concept of the rôle of the estrogenic and progestational hormones
III. The rôle of the placenta
IV. The effect of mineral ions upon the uterus
V. The effect of the estrogenic and progestational hormones upon mineral metabolism
VI. Alterations in blood volume, blood proteins, and acid-base balance in pregnancy

(In the following paragraphs the terms "estrin" and "progestin" are used to connote, respectively, the estrogenic and progestational hormones, and are to be distinguished from such substances as estrone and progesterone, which are highly purified products.)

I. THE RÔLE OF NERVOUS MECHANISMS

It is apparent that the extrinsic nerves are entirely unnecessary for the spontaneous inception and maintenance of labor (136, 98, 66, 47, 157, 100, 111, 17, 81, 91). That they may be concerned under abnormal conditions is exemplified by the occurrence of labor as the result of profound emotional disturbance (65). However, the facts that placentation, pregnancy, and parturition may proceed unhindered after transsection of the spinal cord or after lumbar sympathectomy, or after section of all the extrinsic nerves and removal of the uterovaginal ganglion in the dog (Ivy) are adequate proof that under ordinary circumstances these mechanisms are not necessary to the normal course and termination of pregnancy.

The rôle of the intrinsic uterine plexuses (25, 154) is debatable, since they are obviously concerned in certain special instances, but apparently not in others. These special cases include the induction of labor by dilating bags, or by rupture of the membranes, or other types of mechanical stimulation of the uterus. Local mechanisms may likewise be involved, when labor must be attributed to reflex stimulation, for example, through the use of enemas. It should be remembered, however, that the uterus is a notoriously refractory organ, and unless it is fully prepared to do so, it will not react to these or to any other stimuli (94). Furthermore, those who believe that the stimulation of intrinsic nervous or neuromuscular structures by a growing fetus is responsible for the spontaneous onset of labor will have difficulty in explaining the delivery of placentas at term when all of the attached fetuses have been removed earlier in the period of gestation (92).

The experiments of Reynolds and others (142) stress the rôle of distention of an estrin-primed uterus as a precipitating factor in labor. This theory is not inconsistent with other data in this communication. That the distention of a sensitive uterus may contribute toward the spontaneous termination of the pregnancy is a consideration of importance which cannot be overlooked.

Department of Physiology and Pharmacology, Northwestern University Medical School, Chicago.

II. THE PRESENT CONCEPT OF THE RÔLE OF THE ESTROGENIC AND PROGESTATIONAL HORMONES

The present-day concept of the onset of labor is based, for the most part, upon evidence of the effects of the female sex hormones upon the motor activity of the uterus. The literature upon this subject is most voluminous, and only the more pertinent contributions will be mentioned.

It has now been demonstrated to the satisfaction of most workers that pure estrin, in any of its special forms, is specifically necessary for the initiation and maintenance of co-ordinated, rhythmic motility of the normal uterus (59, 137, 23, 126, 152, 91); also, that as the uterus becomes more profoundly influenced by estrin, so does its reactivity to pitocin increase (121, 149). It is further significant that estrin is ineffective when used *in vitro* (23, 141). When administered *in vivo* it affects the activity of the myometrium only after a latent period of from eight to ten or more hours; contractions may not become maximal until a considerable time thereafter (137). These latter observations indicate that pure estrin has no specific contractile effect upon the myometrium, but rather that (a) it must itself be altered by the organism before it may be utilized properly; (b) it affects other constituents in the body in such a manner that they, in turn, may cause or allow the uterus to become active; or (c) it so affects the permeability of the myometrial cells that they become reactive to normally circulating substances which are capable of stimulating them.

The effects of potent estrogens upon the course of pregnancy may be disposed of briefly by indicating that by varying of the dosage and time of administration, either failure of implantation (35), premature labor (34, 166), or post-mature labor (79) may be obtained, or there may be no significant effect. In those instances in which failure of implantation was observed, the result was due apparently to the production of an endometrium which was unsuitable for nidation. The production of premature labor appears to be the result of the ability of estrin to augment uterine activity and reactivity. The inhibition of parturition by the administration of estrogenic hormone is attributed by Heckel and Allen (79) to the maintenance of the corpus luteum in a functional state as the result of this treatment.

There are numerous reports to the effect that, although elevated throughout pregnancy, the estrin levels reach their highest peak at the time of the onset of labor (23, 189, 31, 28, 135). Furthermore, labor is preceded by a sudden increase in the excretion of the more potent forms of estrin (167, 165, 130). A similar increase was found to occur prematurely, directly prior to a spontaneous abortion (130). These levels are sufficiently consistent with changes in uterine motility that a postulation of causal relationship has seemed justified (140, 88, 86).

The effects of the progestational hormones are almost diametrically opposed to those of estrin. Briefly, progestin causes the formation of an endometrium which is favorable for the inception and maintenance of pregnancy (33); inhibits rhythmic, estral contractions of the uterus (122, 95, 145, 138, 143, 148, 179, 54, 7); and reduces, annuls, or reverses the uterine response to pitocin (7, 107). Adequate doses of estrin, however, can overcome the inhibitory effects of physiological amounts of progestin (158).

It has been demonstrated (94, 93, 144, 150) that the uterus responds well to pitocin during the estral phase, but during pseudopregnancy and early pregnancy it is refractory. As pregnancy proceeds toward term the myometrium becomes increasingly responsive; at the close of gestation an extreme sensitivity is noted. (This is to be correlated with the estrin levels mentioned before.) Allen and his associates (7, 107) have shown that the uterus may be rendered nonresponsive by the administration of crystalline progesterone, but when a small amount of estrin is added as well the uterus may actually relax to pitocin treatment. These workers have adequately demonstrated that the myometrial response to progesterone is enhanced by the addition of a small amount of estrin. This is especially significant in view of the isolation of appreciable amounts of estrin from normal corpora lutea (10, 4, 5).

The effect of progestin upon pregnancy appears to depend upon the purity of the product administered. When impure products containing small amounts of estrin are used, or when luteinization is induced near term by the administration of gonadotropic substances, pregnancy may be prolonged (33, 118, 125, 170, 97); but when estrin-free progestin or progesterone are given, pregnancy is seldom protracted by even large doses (7) unless given at term (78) when the estrin titer is markedly increased.

Browne, Henry, and Venning (28) found the urinary concentration of sodium pregnandiol glucuronidate, regarded as an excretion product of progesterone, to rise continuously up until the eighth month of pregnancy when the peak occurred. They noted a gradual fall thereafter, and the substance could not be demonstrated in the urine twenty-four hours after delivery. The re-

sults of Wilson and Randall (188) differ somewhat from these, in that the urinary concentration was found to increase gradually up until term, when it dropped precipitously.

From these observations, it is apparent that the refractory state of the uterus early in pregnancy results from the influence of progestin, and the increasing activity and reactivity which occur as term is approached are the result of estrin action. When a comparison of estrin and progestin excretion levels is made, one is tempted to the conclusion that earlier in pregnancy the presence of estrin has as its primary effect the enhancement of the quieting influence of progestin, and as the estrin curve rises, its full effect is felt.

III. THE RÔLE OF THE PLACENTA

Evidence has accumulated to indicate that the placenta is, in some species at least, the major source of the autacoids which have been shown to be responsible for the maintenance of pregnancy and, more than likely, the precipitation of labor. The data which substantiate this statement are based primarily upon (a) the isolation of these substances from the placenta (1, 3, 44, 164, 49, 115, 50, 68); (b) their presence in normal concentration in the blood and urine of women who have been castrated earlier in pregnancy (185, 135); and (c) experiments which have demonstrated that the ovarian source of these hormones may, in certain species, be removed without jeopardizing pregnancy.

Ablation of the gonads in pregnancy consists, in essence, of the removal of the corpus luteum. That this structure is essential for adequate implantation has been established (2). However, the ovaries may be excised during gestation in some species without abnormal consequence [human (14, 65, 185, 90, 177, 83, 115); guinea pig (104, 105, 80); mare (73); cat (36)]. The rabbit will generally miscarry if castrated before term (58, 8), whereas the goat, opossum, squirrel, mouse, rat, and bitch will invariably miscarry after bilateral oöphorectomy at any stage of gestation (2, 92, 89).

The question arises as to why in some animals the corpus luteum is necessary until the close of gestation, while in others it frequently may be excised without danger to the pregnancy. The ingenious experiments of Newton (126), Brooksby and Newton (26), Haterius (76), Seyle, Collip, and Thompson (162), Kirsch (92), and others clarify this question, and indicate that the fundamental differences in species response to gonadectomy are a function of the placenta, and depend upon the ability of this structure to serve either as an auxiliary to or a substitute for the ovaries. Its ability to do this undoubtedly depends, in turn, upon its capacity for the elaboration of progesterone (9).

It seems fitting to mention at this point the effect of ablation of the hypophysis during pregnancy. It is reported that hypophysectomy in the pregnant dog (13) and rabbit (56) is followed by the spontaneous termination of pregnancy. In the rabbit this is shown to be due to the regression of the function of the corpora lutea following the operation (144, 169). In this regard, Robson (151) was able to maintain pregnancy for varying periods in hypophysectomized rabbits by causing luteinization or by administering progesterone. In the rat (131) removal of the entire hypophysis is followed by the resorption of embryos if the operation is performed before midgestation, and prolongation of pregnancy and/or interference with the birth processes if done in the latter half of gestation. In this species no regressive changes are noted in the corpora. Ablation of the posterior lobe alone (the stalk being left in place) is reported not to alter the course of pregnancy (168). There is evidence to the effect that in the cat (6) guinea pig (132), and mouse (162) hypophysectomy does not interfere significantly with the normal course of gestation.

The work of Fisher, Magoun, and Ranson (57) rather definitely ascribes to the posterior lobe a function in the birth processes. In 7 pregnant cats the production of degeneration and atrophy of the posterior lobe of the hypophysis did not interfere with the duration of pregnancy or the onset of labor, but there was either partial or total inability to expel the contents of the uterus. Only 3 of the animals survived parturition, the remainder dying in the course of protracted labors. In interpreting these observations, however, it must be kept in mind that such animals have diabetes insipidus. Hence, the disturbance of labor in them may be due to a derangement of the water and electrolyte balance of the body and uterine musculature, rather than to an absence of the oxytocic principle of the posterior pituitary gland.

It is clear that considerable work must be done before a clear conception of the rôle of the hypophysis in pregnancy and labor may be obtained. However, it may be noted that in those species in which the corpora lutea are necessary for the proper course of gestation (dog, rabbit, rat), the hypophysis is likewise essential; conversely, in those forms in which gonadectomy does not interfere with pregnancy (cat, guinea pig), the

hypophysis may be removed without fear of abnormal consequences. The question then reverts to the placenta. It would seem that in animals in which the placenta is unable to manufacture sufficient progestin for the maintenance of pregnancy, it is also unable to elaborate sufficient gonadotropic substance for the preservation of the functional capacity of the corpora, and the hypophysis must act as an auxiliary. This is not a serious objection to the hypothesis that it is the placenta which fundamentally determines the duration of pregnancy. It is more than likely that in the latter species the changes in placental activity at term are sufficient to create the hormonal imbalance necessary for the precipitation of labor. (This discussion brings to mind the so-called species differences which are the bane of endocrinological reviewers. It is quite possible that, just as has been shown here, these variations may be quantitative in most instances rather than qualitative.)

The rôle of the posterior lobe remains in doubt, especially as the result of the work of Fisher *et al.* and their implication that the hypophyseal stalk (which frequently remains *in situ* after hypophysectomy) is a functional portion of the posterior lobe. In Fisher's experiments, however, it is worthy of note that it was the birth processes themselves which were affected and not the timing or the onset of labor.

The suprarenal glands as possible etiological factors in the onset of labor have been adequately disposed of by the work of Allers *et al.* (11). Thus, it is difficult to avoid the conclusion that the placenta is the determining factor not only in the maintenance of gestation, but also in the timing of parturition. Furthermore, this is dependent upon the ability of the placenta to regulate estrin and progestin levels. As Newton points out (127), however, the demonstration of another potent extra-ovarian source of estrin, the activity of which is markedly increased during pregnancy, would definitely impair the case for the placenta. Since this has not been done, one is left with the hypothesis that it is the placenta which is responsible for the phenomena which we have considered. [For more detailed discussions of the control of uterine motility, placental autacoids, and factors concerned in the duration of pregnancy, the reader is referred to the reviews of Reynolds (141), Newton (127), Corner (32), and Snyder (171).]

IV. THE EFFECT OF MINERAL IONS UPON THE MYOMETRIUM

Evidence has accumulated to indicate that uterine activity and reactivity are regulated not alone by the estrogenic and progestational hormones, but also, and perhaps fundamentally, by the mineral ions. Recent reference to the effects of these autacoids upon mineral metabolism has added strength to the hypothesis that it is through alterations in the mineral balance that myometrial activity is fundamentally affected.

It has been pointed out repeatedly that uterine activity (19, 139, 40, 41, 39, 40) and reactivity (184, 40, 41, 159) are augmented by calcium ions; and that a well contracting uterus may be rendered relatively or absolutely quiescent (184, 40, 41, 53, 23, 96) and its sensitivity reduced or annulled (184, 40, 41, 23) by relative calcium lack. The outward similarity of these artificially produced states to those which result from estrin and progestin influence, respectively, has been pointed out (40, 41).

It has been shown further that the absolute amounts of calcium in the circulating blood or in the nutrient fluid are of little importance provided they are adequate (184, 42). The salient feature is the amount of *ionized* calcium, which in turn may depend upon many variables. For example, it is well known that the ionization of calcium is profoundly affected by the concomitant concentrations of protein (116), citrate (52, 117), phosphate (21), or fixed base (20). In this latter respect, a shift of the acid-base balance of the blood toward the alkaline side causes a reduction of the ionic fraction without alteration of the total serum calcium value. It has been suggested (160) that the increased alkaline reserve may allow the proteins to combine with more of the calcium to form un-ionized compounds, and thus introduce an added variable. With these facts in mind, it should be apparent that the analyses of either sera or tissues for total calcium are not reliable criteria of the amount physiologically available for utilization. A similar conclusion likewise may be applicable to certain other blood and tissue constituents, since their absolute amounts by no means reflect necessarily their effective concentrations.

Evans, in his review of the physiology of plain muscle (52), states that it is best to consider calcium in its relation to potassium, since there appears to be an ionic balance between the two, the addition of one having generally the effect of withdrawal of the other. The experience of others (18, 69, 101, 75, 77, 113) and ourselves (42, 39) substantiates this statement, notwithstanding reports to the contrary (156, 183). Furthermore, we have found the absence of potassium to be just as potent a stimulus to the isolated uterus as the excess of calcium.

The effect of magnesium and sodium ions upon the uterus has received little attention. Van Dyke and Hastings (184) observed that the sensitivity of the guinea-pig uterus immersed in a bath containing 1.0 millimoll of magnesium per liter was depressed by either the addition or withdrawal of magnesium. We have found further (67) that spontaneous activity is depressed by magnesium, the duration of the depression being directly proportional to the amount of magnesium added. This corroborates the findings of Reynolds (139). Concerning sodium, the data is more unsatisfactory. In our experience with *in vitro* experiments, the effect of sodium *per se* is nil, either increased or decreased amounts having no significant effect.

It seems justifiable to summarize these findings by constructing the tentative working relation:

$$\frac{Ca^{++} + H^{+}}{K^{+} + Mg^{++} + OH^{-}}$$

upon which uterine motility might be thought to depend. An increase in the concentrations of either of the ions in the numerator would tend to enhance activity and reactivity, while an increase of those in the denominator would depress. If such a relationship is shown to be correct, then it becomes apparent that the uterus is dependent not upon any one ion for the state of its activity, but rather upon the relation of that one ion to the concentrations of at least four others.

V. THE EFFECT OF THE FEMALE SEX HORMONES UPON THE MINERAL METABOLISM

Within recent years the effect of the female sex hormones upon mineral metabolism has received much attention. Although our knowledge of this interrelationship is incomplete, certain facts have emerged which undoubtedly have a direct bearing upon the question under discussion. One of the earliest references to this matter is that of Rossenbeck (155), who postulates, with little pertinent data, that the corpus luteum may effect such changes in the mineral ionic balance that, finally, at the onset of labor the ionic concentration in the uterine muscle is optimum for its response to the stimulus of the posterior lobe of the hypophysis. Our present knowledge suggests certain alterations in this hypothesis; recent evidence, however, has tended to substantiate rather than refute its basic implication.

In regard to calcium, it should be emphasized again that estimations of total blood calcium give no indication of the concentration of active calcium in the circulation. Reports of declines of serum calcium in pregnancy (123, 55, 187, 29) rises, (114), and declines with cyclic alterations in ovarian activity (114, 85), or rises (24, 163, 182), or declines after the menopause (108, 38), are all interesting, but unless marked changes are present the results give little insight into the true state of affairs. Studies of this sort may be complicated further by demonstrated blood volume changes at these times.

Reports of an increase in the blood calcium of pigeons, rats, doves, fowls, capons, and dogs after the administration of estrin (147, 146, 12) have been denied by some workers (103, 109, 110, 120, 84). Further, both osteoporosis (16) and hypercalcification of the skeleton (60) have been reported to follow such treatment.

In spite of these conflicting reports, certain observations have demonstrated unequivocally that calcium metabolism may be influenced profoundly by the female sex hormones. Since generalized tetany of the skeletal muscles must be attributed directly or indirectly to relative calcium lack, then the occurrence of this phenomenon as the result of estrin or progestin influence would be strong evidence in favor of such an interrelationship. In this respect it has been demonstrated that in recently parathyroidectomized animals, or in parathyroidectomized animals maintained on minimal amounts of parathormone, tetany may be regularly precipitated by the occurrence of estrus (106, 45, 46), or pregnancy (45, 46), or by the administration of anterior pituitary-like substance from the anterior pituitary lobe, estrin, or progestin (112). It thus appears as though both estrogenic and progestational hormones are capable of diminishing the available calcium. Although there is no evidence favoring such a view, it seems quite possible that in the one instance the lowered active calcium may result from utilization or fixation, whereas in the other the calcium may be rendered non-utilizable, or may be excreted. Blair-Bell's finding (22) of a 50 per cent reduction in calcium excretion after castration in cats lends support to this explanation.

The interrelationship of the female sex hormones with sodium metabolism has been investigated only recently; however, sufficient evidence has warranted certain conclusions.

Among the earliest references to this subject is that of Rogoff and Stewart (153), who noted that the occurrence of estrus in dogs caused a marked prolongation of the survival time and the period of good health following adrenalectomy. This finding has been amply confirmed, and has been extended to show that artificially induced estrus and pseudopregnancy have a similar ameliorating effect (178, 63, 48). Furthermore, Swingle *et al.*

(178) have shown that during the period of health the *serum sodium levels remain within normal limits*. The ameliorating effect of these states, then, is due obviously to the sodium retention which attends them, and one must assume that it is the estrogenic and progestational hormones which cause this retention. This possibility has been investigated (181, 71, 72), and it has been found that progesterone, estrone, and estradiol all produce sodium retention, which is manifested by a diminished excretion of this substance. However, Swingle *et al.* (178) state that with the possible exception of progesterone, none of these substances may act as a cortical substitute. Gaunt and Hays (64) have now succeeded in maintaining life in adrenalectomized ferrets with progesterone alone and have found estrone to be markedly toxic for these animals; the same is true for rats (186). Moreover, Gaunt (62) has raised the question as to whether the ameliorating effects of estrus in the dog are not in reality due to the ovulation and pseudopregnancy which closely follow this short period. In support of this contention he has shown that in the ferret, estrus (which endures for a considerable period in this animal) will precipitate crises of cortico-adrenal insufficiency in animals adrenalectomized and maintained on previously sustaining doses of cortical extract and salt.

Many of the fundamental features of this interrelationship have yet to be worked out, not the least important of which is the fate, in each instance, of the retained sodium; that is, whether it may be found in the intracellular or extracellular spaces, in the plasma, or at the cell surfaces. At the present time any further analysis of this question would be pure conjecture, and is beyond the scope of this review. However, the implications are undoubtedly far-reaching, if obscure. In view of the marked and selective effect which these hormones have upon uterine contractility, it is not illogical to assume that the myometrial cells might likewise be profoundly affected as regards their sodium, or fixed base, balance. If this were true, then the local concentration and availability of other essential ions might be influenced secondarily. That is, the autacoids or hormones affect uterine irritability and contractility by affecting and regulating the ionic state of the uterine musculature.

VI. ALTERATIONS IN THE BLOOD VOLUME, BLOOD PROTEINS, AND ACID-BASE BALANCE IN PREGNANCY

Blood volume. It is generally agreed that there is an increase in blood volume in pregnancy (172, 119, 174, 161, 43, 129), which begins early in gestation (180), reaches its maximum at about the end of the eighth month (180), and declines toward normal thereafter (129, 180, 99, 30). It is believed that the blood dilution is ascribable to retained water and that this factor may account, at least in part, for the weight increase in pregnancy which is out of proportion to the mass of the products of conception (26, 61). This correlation with blood-volume curves is also suggested by the reports of weight loss in the immediate prenatal period (82, 190, 163, 37, 51).

Thompson *et al.* (180) suggest that these phenomena may have a hormonal basis, since they have been observed to occur as early as the third week, before there is any possibility of mechanical etiology. These authors also call attention to the fact that the blood volume starts to approach normal just at the time when the estrin curve is increasing.

Blood protein. A decrease in the total blood protein during pregnancy has been a constant finding. This decline has been shown to occur early in pregnancy and reach a maximum during the sixth month. There is a slight increase during the later months, a sharp rise during labor, a precipitous drop in the puerperium, and the values return to a normal level from one to three weeks after delivery (133, 134). It has been suggested (176) that the lowered blood protein is the primary factor in conditioning the water retention of pregnancy. However, this explanation does not dispose of the fact that frequently the protein levels in pregnancy may not pass the bounds of normal. Furthermore, in some instances there may be little correlation between the protein levels and the amount of water retention. It might seem more logical to ascribe the lowered protein to blood dilution (133) rather than the reverse, and to agree with the view of Ivy and Gray (87) that the inorganic ion balance is perhaps of more fundamental importance.

Acid-base balance. The carbon-dioxide combining power of the blood is definitely decreased at term, when it is approximately 45 volumes per cent as compared with 65 volumes per cent in nonpregnant women (173). Stander (173) concludes that in pregnancy there is a compensated alkali deficit, rather than a true or definite acidosis. The total serum base in pregnancy may be reduced as much as 5 per cent or more (175, 128). Harding and Allin (70) state that it has been demonstrated repeatedly that there is a reduction in the alkaline reserve which is demonstrable as early as the third month. Attention has been called to the unique ability of the pregnant organism to

tolerate a reduced concentration of serum electrolytes, and the paradox of lowered serum sodium levels in the face of an obviously developing water retention (128). The fact that in pregnancy an adequate plasma volume is maintained at lowered electrolyte levels calls to mind the ability of the adrenal cortical hormone to produce precisely the same set of circumstances (74).

SUMMARY AND CONCLUSIONS

This paper is presented not as a hypothesis, but rather as an attempt to correlate, for pedagogic and possibly for practical purposes, the available data at the present time which may bear upon the problem of the onset of labor. The minor or negligible influence of nervous mechanisms as primary causative factors has been pointed out. Although the precise mechanism by which the hormones act is unknown, it has been demonstrated that in all likelihood gestation is maintained by progestin, and labor precipitated by estrin. The essential rôle of the placenta in regulating the proper concentrations of these hormones has been stressed.

Calcium has been shown to be essential for uterine contraction. The similarity of the uterine response to progestin and to calcium deprivation, and of the response to estrin and calcium in excess, has been pointed out. The acid-base balance of the body is an important factor in the regulation of the availability of calcium, a relative alkali deficit favoring its activity.

There is evidence in support of the contention that the plasma alkali deficit and increased blood volume of pregnancy are dependent upon the interaction of the estrogenic and progestational hormones, and are brought about through the ability of these autacoids to regulate the metabolism of sodium, or fixed base. In spite of the fact that both groups of hormones produce sodium retention, only one, progesterone, is capable of acting as a cortical substitute. This seems to be direct evidence of the fact that the retention due to estrin influence is different from that due to progestin. When one progresses further than this, unstable ground is reached. However, it is not unlikely that through alterations in the metabolism of fixed base, which have been shown to occur as the result of the influence of these substances, the utilizable fractions of calcium and other essential ions might be altered secondarily and the motility response of the uterus so regulated. Such a hypothesis, though obviously incomplete, might aid in the explanation of the delayed response of the myometrium to injections of estrin and progestin, might point to certain therapeutic measures which are more direct than the use of glandular extracts, and, further, might indicate a fundamental approach to the problem of the regulation of uterine contractility. Proof of these postulations must await a satisfactory method for the estimation of ionic calcium.

The precipitation of labor at term is not due to any one factor, but rather results from a combination of many. Among the factors which would contribute to so "priming" the uterus are: (a) the increasing estrin concentration in the face of apparently regressing progestin levels, (b) the probable increase in active calcium, and (c) increasing distention, which invariably produces gradually increasing contractions in any hollow viscus.

ADDENDUM

For more detailed consideration of certain of the subjects which have been reviewed here, the reader is referred to the current edition of "Sex and Internal Secretions" (191), and to Reynolds' book on "The Physiology of the Uterus" (192), both of which have appeared since this article was submitted for publication. Lack of space prevents an adequate consideration of many other recent and pertinent contributions to this rapidly fluctuating subject.

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OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Brindeau, A.: Aseptic Necrobiosis of Fibromyomas in Pregnant Women (La nécrobiose aseptique des fibromyomes chez la femme enceinte). *Rev. franç. de gynéc. et d'obst.*, 1939, 34: 193.

Under the classification of aseptic necrosis or necrobiosis of uterine fibromyoma, Brindeau includes not only red degeneration of fibromyomas in pregnant women, but also necrosis with edema advancing in some instances to a pseudocystic formation. The pathogenesis of the two types is the same. The histological appearance varies according to the degree of the necrosis; the necrotic areas may be scattered throughout the tumor with fairly normal areas between them; or the necrosis may be almost complete and the muscular tissue almost completely destroyed. Often there is considerable edema of the muscular fibers, which terminates in necrosis, and often there are interstitial hemorrhages.

Aseptic necrobiosis of uterine fibromyoma is of much more frequent occurrence in pregnant than in non-pregnant women. Pregnancy is a definite factor in the production of this type of necrosis by causing ischemia of the tumor which is normally not extensively vascularized, by displacement of the tumor, and by dissociation of the smooth muscle fibers.

The most frequent symptoms of aseptic necrosis of fibromyoma during pregnancy are pain—which is not severe at first, but may later be manifested in definite attacks with a peritoneal reaction—vomiting, abdominal distention, and constipation. The tumor is palpable and increases rapidly in size; it is relatively soft in consistency, sometimes almost fluctuating. Under treatment with rest and morphine, the crisis may subside; in other cases, there may be recurrences which necessitate surgical intervention.

Various complications may also make surgical intervention necessary. Infection of the tumor, although it may occur, is fortunately rare during pregnancy; if the tumor lies low in the uterus, it may be infected by organisms from the vagina. Torsion of the pedicle occasionally complicates aseptic necrosis; and hemorrhage into or around the tumor may be severe enough to cause symptoms. In case of spontaneous abortion, the tumor may render expulsion of the fetus difficult and infection may result.

In case the crises of pain cannot be controlled by medical treatment, or in case of such acute complications as torsion of the pedicle, sudden growth in size of the tumor, internal hemorrhage, or infection, surgical intervention is necessary. If the pregnancy is not at or near term, myomectomy is indicated; in 88 per cent of the cases in which this operation was done, the pregnancy continued normally. If the pregnancy has advanced until the child is viable, a low cesarean section may be done, followed by myomectomy or, if necessary, by hysterectomy. If the tumor causes no serious symptoms until the time of labor, the woman may often be delivered spontaneously if the tumor does not cause dystocia. If the fibroma obstructs the os, a low cesarean section is done at term or at the beginning of labor, followed by myomectomy or hysterectomy. If the woman is delivered normally, the presence of the tumor usually causes no complication in the puerperium; if infection develops, hysterectomy is indicated as a rule, but in 1 of the author's cases a putrefied polyp was removed *per vaginam* in the puerperium. Among 59 cases of aseptic necrosis of fibromyoma in pregnancy in which operation was done, there were 5 deaths; myomectomy was done 41 times with 3 deaths; hysterectomy 18 times with 2 deaths.

ALICE M. MEYERS.

LABOR AND ITS COMPLICATIONS

Huber, C. P.: Duehrssen's Incisions. *Am. J. Obst. & Gynec.*, 1939, 37: 824.

This review of 162 instances in which Duehrssen's incisions of the cervix preceded delivery shows that the procedure is not without danger. It should be considered as a major obstetrical operation and should be done only in carefully considered circumstances in which the termination of labor becomes imperative in the interests of either mother or infant. It should not be postponed, however, until the condition of the patient and her baby increases the danger associated with its performance. Duehrssen's incisions are not to be considered at the onset of labor as a method of facilitating the delivery. The following statements concerning their employment seem justified:

1. Duehrssen's incisions are indicated in a limited group of cases, in which the cervix is effaced but incompletely dilated.

2. In most instances indications for their use arise in the presence of prolonged labor, with failure of cervical dilatation and the development of maternal exhaustion and uterine inertia.

3. The unrotated or incompletely rotated occipitoposterior position is a factor in the production of conditions indicating Duehrssen's incisions.

4. Duerssen's incisions are indicated twice as frequently following the induction of labor as they are subsequent to the natural onset of labor. Induction of labor in the presence of a firm, long, undilated cervix is often dangerous from this standpoint.

5. The danger of hemorrhage subsequent to incision of the cervix is increased when difficult operative delivery is necessary. It is always a real danger, as has been shown by a 16 per cent incidence of hemorrhages of more than 500 c.cm. of blood.

6. There is less danger of extension or of cervical laceration when 3 cervical incisions are made than when 1 or 2 are made.

7. The morbidity of 27.2 per cent is high. Infection should not be ignored, even though there were no maternal deaths in this series.

8. The fetal mortality of 13.0 per cent is high, but the review suggests that some fetal lives have been saved.

9. Subsequent obstetrical difficulty is not demonstrably increased by the performance of Duehrssen's incisions. EDWARD L. CORNELL, M.D.

PUERPERIUM AND ITS COMPLICATIONS

Lucchetti, G.: A Contribution to the Study of Metabolism of Ascorbic Acid in the Puerperal State and in Gynecological Disorders (Contributo allo studio del metabolismo dell' acido ascorbico nello stato puerperale e nelle affezioni ginecologiche). *Riv. ital. di ginec.*, 1939, 22: 141.

Lucchetti has used Rotter's cutaneous reaction for the estimation of the Vitamin-C content of the organism in 285 women; this reaction is based on the fact that 2-6 dichlorphenol-indophenol is discolored by the tissues at a speed depending on their content of Vitamin C. The approximate exactness offered by the method was thought to be sufficient for the purposes of this investigation, which was conducted on subjects who took the average diet of the working class of Rome and could be divided into two groups, one of which received an average amount of Vitamin C, and the other a large amount, through the addition to the diet of such foods as fruits, salads, and milk. The following conclusions were reached in the course of the investigation:

Non-pregnant women, receiving the average diet which, although not rich, is not poor in Vitamin C, had a tissue content of ascorbic acid sufficient for the needs of the organism. Consequently, in those who received a large additional amount of Vitamin C, a condition of saturation occurred which represented the optimum of tissue content of this vitamin.

In the puerperal state, normal pregnant women under similar dietary conditions showed a decidedly lower tissue content of Vitamin C than that found in the controls. The Vitamin C contained in the average diets covered the requirements of their organism, but may have been insufficient in some cases, while the diet with additional amounts of the vitamin protected the woman against this eventuality. The tissue content of Vitamin C of the pregnant woman decreased proportionately to the exaggerated demands made by the pregnancy, especially when the pregnancy was prolonged beyond term or when twins were involved. Women during labor showed a slightly higher Vitamin-C content than normal pregnant women and than those who did not nurse their children; the latter presented values nearly equal to those found in normal pregnant women, but with a tendency to acquire gradually the values of normal women as the puerperium advanced. Puerperal women who nursed their children had a lower tissue content of Vitamin C than all the other groups, especially during the first days of nursing. Thirty per cent of the women receiving the average diet and 4 per cent of those receiving additional amounts of the vitamin were in a state of hypovitaminosis. As the period of nursing advanced, the tissue content of Vitamin C gradually approached the values for normal women.

In the most common complications of the puerperal state of toxic origin (hyperemesis, pruritus of pregnancy, and eclampsia) with association of infections (puerperal fever and pyelitis), as well as in the prevailingly hemorrhagic forms (late hemorrhage of the puerperium and hemorrhage due to postpartum atony), the Vitamin-C content of the tissues was usually within normal limits. Hypovitaminosis was found in 16.6 per cent of patients presenting the various aspects of abortion.

In cases with gynecological disorders, the Vitamin-C content of the tissues was somewhat lower than normal in adnexal inflammations only, and was generally normal even in the prevailingly hemorrhagic forms of gynecological disturbances, such as functional, post-abortum, and endometritic hemorrhages. In women with epithelioma, the vitamin content was found to be somewhat higher than normal.

In some disease forms, especially in hyperemesis, in which no Vitamin-C deficiency was demonstrated, the administration of ascorbic acid has nevertheless been beneficial; it probably acts through a pharmacodynamic mechanism independent of its specific vitamin action. RICHARD KEMEL, M.D.

Hansen, R.: Post-Partum Collapse (Der Geburtskollaps). *Arch. f. Gynaek.*, 1939, 168: 313.

The author presents an interesting classification and differentiation of the various types of postpartum collapse. He describes 6 different forms.

The anemic collapse which usually follows excessive hemorrhage is due to the blood loss which causes the peripheral organs to lose their ability to respond to the intact nerve impulses.

The purely nervous shock is characterized by severe nervous reflex vascular collapse. Goltz's experiment is regarded as a prototype. The nervous reflex collapse may occur during forceful Credé separation of the placenta.

In addition, a mixed anemic-nervous form of collapse is to be differentiated. It generally occurs in cases of uterine inversion, premature separation of the placenta, and uterine rupture. In cases of this type the blood loss is combined with nervous reflexes which lead to partial dilatation of the vascular system and therefore to a pooling of the remaining blood.

Toxic collapse is primarily due to blood poisons which are important in eclampsia, peritonitis, and other septic conditions. The possible rôle of acetylcholine from the placenta as a factor in toxic collapse is suggested.

Other forms of collapse are the febrile collapse, as well as the collapse due to diseases of the heart, lungs, and thorax. The latter forms of collapse are

essentially the expression of the failure of the central circulatory apparatus, the heart, although a peripheral component may be present.

The different forms of collapse were accurately distinguished from one another with regard to their symptoms and therapy.

(GAEHTGENS). RONALD R. GREENE, M.D.

Sheehan, H. L.: The Pathology of Obstetrical Shock. *J. Obst. & Gynaec. Brit. Emp.*, 1939, 46: 218.

The criterion of obstetrical shock employed is wider than that in common clinical use. A patient is said to have had obstetrical shock if she died with the clinical appearances of shock during labor or within twenty-four hours after delivery, whether or not an explanation for the shock had been recognized before death. The material studied was restricted to those fatal cases of obstetrical shock in which post-mortem examinations were performed in the Glasgow Maternity Hospital during the last five and one-half years. Fatal cases in which hemorrhage, the anesthetic, or other such factors were the primary cause of death are excluded. Also excluded are sudden heart failures due to chronic valvular disease, circulatory collapse in certain cases of toxemia, acute pulmonary edema, and all cases in which death occurred in the first half of pregnancy.

The cases of obstetrical shock were grouped as follows:

Cause of shock	No. of cases
1. Dystocia	29
2. Ruptured uterus	13
3. Retained placenta	22
4. Uteroplacental apoplexy	21
5. Uncomplicated cesarean section	4
6. Complicating disease	8

The clinical features of Groups 1 and 2 were similar, i.e., shock occurred during or shortly after labor because of hard operative delivery following a prolonged labor which was blocked for one of several reasons, such as pelvic contraction or unfavorable position. A small number (6) of the uterine ruptures occurred spontaneously.

In Group 3, 6 patients died within from two to three hours after delivery. Hemorrhage was extreme in these cases and was probably of more significance than the shock. The remaining 16 patients in this group died from four to twenty-four hours after delivery, and the essential cause of death seemed to be shock, as hemorrhage was not a major feature. In 12 patients there had been frequently repeated but unsuccessful attempts to express the placenta. In 4 patients the placenta was expressed with a good deal of force (2 of these had inversion of the uterus).

The author believes that patients with uteroplacental apoplexy usually die of shock, not hemorrhage. Twelve patients were close to term and 9 had been pregnant between twenty-seven and thirty-three weeks. Nine patients died undelivered; most of them had had many babies and were obese. In 3 cases, post-partum hemorrhage was so severe that it probably was a significant factor in the cause of death.

The operations in Group 5 were performed on primiparas for contracted pelvis. One patient experienced a fairly severe hemorrhage; the others did not. Shock and death occurred in from two to five hours.

In the last group, in which there were 5 spontaneous deliveries, death followed clinically characteristic shock within eight hours. The diagnoses in these cases were varied; 4 patients had definite evidence of previous hypertension; the others had pneumonia, acute pancreatitis, renal disease, and influenza, respectively.

The pathological findings were as follows:

Vascular system in general. There was no obvious pooling of blood in the abdominal viscera, the muscles of the thigh, or in the large veins.

The heart. One of the most common findings in obstetrical shock was the presence of subendocardial hemorrhages on the left of the interventricular septum, and occasionally at the base of the papillary muscles in the left ventricle. These hemorrhages were found in one-third of the cases, and were much more common in those cases in which shock had been present for six or more hours before death. Such lesions have been found rather more infrequently in the following conditions: general shock, lesions of the brain and vagus nerve (fractured skull, cerebral hemorrhage), purpuric diseases, and hypertensive toxemia. A possible significance of these hemorrhages is their position over or among the fibers of the conducting system, and their indication of an alteration in capillary permeability.

Lungs. There were no characteristic findings. In some cases the lungs were dry and anemic and in others they were congested and edematous. Petechial hemorrhages were found occasionally.

Stomach. Acute dilatation was a rather common feature in the cases of dystocia.

Uterus. The local uterine findings naturally depended upon the condition present. Rupture was an obvious lesion; the author believes that the hemorrhage in such cases was insufficient to account for death. In uteroplacental apoplexy the usual finding was multiple hemorrhagic lesions under the peritoneum and in the outer layers of the uterine muscle. In several of the cases of dystocia, necrosis of the uterine wall was found.

Ovaries and pelvic floor. These showed nothing characteristic.

Pituitary gland. There were no recognizable lesions in the hypophysis if the patient had died within from twelve to fourteen hours after delivery. If the patient had lived for several days and then died, necrosis of the anterior lobe was common. The author thinks that this might be significant.

Brain and adrenals. These organs presented no specific lesions. DANIEL G. MORTON, M.D.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Bassi, P.: The Action of Staphylococcic Toxin on the Kidney Subjected to Interrupted Temporary Suspension of the Arterial and Venous Circulation (L'azione della tossina stafilococcica sul rene sottoposto ad interruzione temporanea discontinua della circolazione arteriosa e venosa). *Ann. ital. di chir.*, 1939, 18: 187.

Bassi has shown in a previous study that the changes found in the functional cells of the kidney subjected to interrupted temporary suspension of the circulation are transitory and rapidly reversible. The aim of his present study was to determine the effect of intravenous injections of staphylococcic toxin on the kidney treated in the same manner. Therefore, he used a diluted twenty-four-hour culture of hemolytic staphylococcus aureus on agar, 1 c.cm. of which he injected every twenty-four hours for a varying number of times into the marginal vein of the ears of rabbits of an average weight of 2 kgm., after the rabbits had been subjected to 6 periods of five minutes each of interruption of the circulation of the left kidney at intervals of one minute. The rabbits were killed after twenty-four hours, four days, and six days; to serve as controls, 3 rabbits, in which only the toxin was injected, were killed after the same lapses of time.

The experiments confirmed the results obtained by other authors: there were severe vascular and parenchymatous changes. However, an interesting observation was made in the animals killed after twenty-four hours, which had received only one injection of toxin: the right kidney was normal in 3 of the 5 rabbits used and showed some degree of hyperfunction, while there were very moderate intertubular cortical hemorrhages in the 2 other animals. The left kidneys of the 5 rabbits presented already evident histological changes in the parenchyma and the vessels, decidedly more intense in the former than in the latter. These changes were undoubtedly related to the action of the toxin, as the temporary interruption of the circulation had never caused such severe changes in either of the elements. However, this interruption acted unfavorably on the kidney by causing alterations in the cells of the tubules, which became less resistant to the toxin.

In the rabbits killed four days after the first injection, the parenchymatous and, especially, the vascular changes were more severe: there were necrotic zones and great extension of the altered zones in the parenchyma, and degenerative lesions of the glomeruli and vessels which were not at all in evidence in the first group of animals.

After six days, there were zones of necrosis surrounded by leucocyte infiltration and, around these, vascular thrombosis indicating the pathogenesis of their formation. However, these findings did not apply to every case, as even cortical necrotic foci were observed in various forms, as well as deeply altered and thrombosed vessels in zones in which there were only degenerative lesions of the tubular epithelium. It is probably more correct to consider that the toxin acts directly on the cells of the tubules as well as on the vessels, and causes phenomena of degeneration or necrosis in the first, and degeneration of the walls and thrombosis in the second. This would explain the initial intertubular hemorrhages through alteration of the capillaries, to which the experimental disturbance of the circulation may have contributed. The absence, at this time, of glomerular changes suggests that these vessels are more resistant to the action of the toxin than the capillaries of the tubules. RICHARD KEMEL, M.D.

Kaijser, R.: The So-called Spontaneous Perirenal Hematoma (Ueber das sogenannte perirenale Haematom). *Upsala Läkaref. Förh.*, 1939, 44: 283.

The author presents a review of the various causes of spontaneous perirenal hematoma, based in part upon his own observations.

In all perirenal hematomas originating in the kidney itself, either reduced coagulability of the blood or gross changes in the renal vessels, usually the arteries, are present. That the hemorrhages are not due to diapedesis is shown, according to the author, by the circumstance that the perirenal hemorrhages of infarcts occur almost exclusively in septic infarcts in which there is the greatest possibility of an immediate lesion of the small-sized and medium-sized arteries. In some cases, of course, the renal origin of the hemorrhage is not demonstrable. It is possible, moreover, that smaller aneurysms or other gross changes may have been overlooked. Probably also vasomotor disturbances may be responsible for the hemorrhages. In the discussion of the diagnosis the author points to the importance of the triad of phenomena established by Wunderlich: namely, pains, increasing fullness of the kidney region, and signs of internal hemorrhage. It is important and therapeutically advantageous to make an exact diagnosis of the cause of hemorrhage not only in general but also in the individual case. To this end the author gives some directions with regard to the roentgenogram.

Without operation, the prognosis of perirenal hematomas is considered unfavorable. The mortality is estimated between 40 and 60 per cent. However, with or without operation, the prognosis depends in great measure upon the actual cause of the development of the hematoma. According to Barthels, cases which develop slowly without acute symptoms appear to be more favorable prognostically. Adrenal hemorrhages and those associated with hemophilia terminated fatally almost without exception.

Finally, in conjunction with a personal observation presented in detail, some cases from the literature are described, which show that perirenal hematomas occurring in connection with septic infarcts usually develop in the course of acute infection, run a febrile course, and present such characteristic features that they constitute a distinct uniform type of disease, recognizable in typical cases. (HEINEMANN-GRUEDER). J. M. SALMON, M.D.

Campbell, M. F.: Ureteral Obstruction in Children. *J. Urol.*, 1939, 41: 660.

Among 12,080 autopsies in children, congenital stricture was found in 0.6 per cent. Ureteral obstruction may be acquired during early life. In persistent urinary infection in children (so-called chronic pyelitis) ureteral blockage is demonstrable as the principal factor most often. Congenital ureteral obstructions in the young include: stricture, reduplication, aberrant vessels, kinks, folds, diverticulum, torsion, ureterocele, blind ureteral ending, abnormal ureteral insertion including ectopy, and cyst. Acquired ureteral obstructions include: traumatic and inflammatory stricture, stone, tumor, and extra-ureteral pressure from tumors, cysts, enlarged lymph glands, and adhesions; in one case ureteral gumma caused obstruction.

The pathological changes in the urinary tract proximal and consequent to the obstruction are often asymptomatic even though pronounced. If the obstruction is unrelieved, hydronephrotic destruction results, and when infection sets in, irreparable renal injury is common and demands nephrectomy. The etiological relationship of ureteral obstruction to renal calculus is the same as in adults. Usually the urological investigation is prompted by persistent urinary infection (so-called chronic pyelitis of childhood). Successful methenamine chemotherapy at once suggests the absence of urinary stasis. Persistent pyuria is the most common objective symptom. The pyuria may be found accidentally, but usually follows a previously acute infection (pyelitis). The common story is that of recurrent attacks of "pyelitis," usually coincident with focal infection elsewhere, especially in the tonsils or adenoids, rhinitis, laryngitis and dental infection, or acute intestinal disturbances. In the absence of infection advanced renal damage from obstruction may give the clinical and laboratory picture of chronic interstitial nephritis. In advanced bilateral hydronephrosis the late renal pathology may be that of nephrosclerosis (renal rickets). The only subjective symptom is pain in the loin. Dietl's crisis or the typical stone colic are less common. Hematuria often results from hydronephrotic distention but may be due to stone mobilization. Gastro-intestinal disturbances are notable in at least one-fourth of the cases and may be produced reflexly with unilateral obstruction. With bilateral obstruction and advanced renal injury there may be urinary toxemia with anorexia, constipation, loss of weight or failure to gain, malaise, and increasing debility. Fever is usually low; with fresh infection or acute exacerbation of a smouldering infection from obstruction, the picture is that of "persistent acute pyelitis" and requires free urinary drainage or nephrectomy. With advanced renal injury, urotoxemia is evidenced by headache, hyperirritability, mental lassitude, later stupor, and death.

The diagnosis is often suggested by persistent or recurrent pain along the upper urinary tract. Excretory urography often satisfactorily demonstrates the obstruction, but is of no help when renal function is diminished. The anatomical diagnosis can usually be made by retrograde ureterography. Urological investigation should be done in any child in whom persistent pyuria resists intense medical therapy for from four to six weeks. Sterilization of the urine by mandelic acid and sulfanilamide in "chronic pyelitis" should not exempt the child from excretory urography, for the persistent infection suggests the presence of urinary stasis. A complete urological study is also indicated for persistent frequency, urgency, difficulty, or other urinary disturbances, hematuria not due to glomerulonephritis, for tumor or pain along the course of the urinary tract, and especially in cases of persistent hyperacute renal infection.

The fundamentals of treatment are: (1) the establishment of free urinary drainage with eventual eradication of the obstruction, and (2) bacteriological cure of complicating infection. The prognosis, therefore, depends on the degree of renal damage by urinary back pressure and infection.

Ureteral stricture is congenital about once in every 150 children. Most of these strictures are simply exaggerations of normal ureteral narrowings. Fibrosis may be present, even without infection. Two-thirds of the congenital strictures are at the ureterovesical junction, nearly a third at the ureteropelvic junction, and the remainder in the body of the ureter. When ureteral obstruction is high, the renal damage is likely to be more extensive. With low blockage, the adjacent proximal ureter shows the earliest dilatation. In the diagnosis of ureteral stricture, instrumental exploration and urography are indicated. Grasping of a No. 4 F. catheter is presumptive evidence of stricture, and ureterography will demonstrate ureteral dilatation above the narrowing. In older children, bulbous bougies of larger caliber may be used, but one must not be confused by the normal ureteral narrowings in the lower ureter or by localized ureteral narrowing. Ureterospasm seldom produces the same picture on all films on the same or on different days unless a local provocative lesion exists.

The treatment of congenital ureteral stricture may be (1) conservative, (a) instrumental, or (b) surgical; or (2) radically surgical. Conservative instrumental treatment means periodic progressive dilatation with bougies. Strictures of the upper ureter seldom respond to this treatment. The author has devised a 17 F. cysto-urethroscope which accommodates bougies including 10 F. for this pur-

pose. Dilatation to 6 or 7 F. usually suffices for infants, but children of three or four years should be dilated to 10 F. Treatment may also be carried out by passage side by side of 2, 3, or 4 No. 4 catheters through a regular miniature cystoscope. Usually early dilatations are done at intervals of from ten to fourteen days, and dilatations should be continued until the stricture remains dilated.

Conservative surgical treatment of ureteral stricture is concerned chiefly with cystoscopic ureteral meatotomy in ureterovesical junction stricture. If this fails the stricture is divided through the opened bladder.

Most strictures of the body of the ureter can be treated by cystoscopic dilatation. If this is not possible, nephrectomy is indicated more often than a plastic operation. Apparent stricture from extra-ureteral pressure may be treated by ureterolysis. Stricture of the pelvic outlet rarely responds to cystoscopic dilatation. The author has had poor results from ureteropelvoplasty. The eradication of obstruction by aberrant vessels or fibrous bands often gives good drainage. Advanced cases may require nephrectomy.

Ureteral injuries following trauma to the loin with resulting stricture is possible. A traumatic stricture may result from careless or unwise ureteral dilatation. Traumatic ureteral stricture is extremely resistant to dilatation and nephrectomy may be necessary. Excision of the stricture with end-to-end anastomosis is not recommended because of the small caliber of the ureter and the possibility of the reformation of a denser stricture. Preliminary nephrostomy or ureterostomy for drainage aids determination of the renal capacity; if the kidney proves valueless nephrectomy is indicated.

A ureterocele may be observed cystoscopically. In girls it may protrude through the urethra. The author has observed 33 cases, bilateral in 7. The pathology, symptoms, diagnosis, and treatment are the same as for ureterovesical junction stricture. The tight meatus is the important lesion. The various methods of treatment include: (1) division by a cystoscopic electrode; (2) cystoscopic dilatation by a large bougie; (3) suprapubic excision and running suture about the base of the ureterocele. Advanced ureteral and pelvic dilatation and infection may demand ureteronephrectomy.

Ureteral reduplication is complete in a fourth of the cases. When the stricture does not respond to conservative dilatation, ureteroheminephrectomy with removal of the obstructed ureter is indicated.

Ureteral kinks are more often consequent to peripheral obstruction than to congenital malformation; they are often observed secondary to lower urinary-tract obstruction. Secondary periureteritis may firmly bind down a secondary kink and require surgical mobilization. In kinks secondary to ureteral obstruction, ureteral dilatation usually diminishes or eliminates the angulation.

Ureteral valves rarely cause obstruction. They are observed in late fetal and neonatal life in about 20 per cent of the bodies, but usually disappear during the first six months after birth. The author has found it post mortem in a boy aged seventeen. The treatment is that of the secondary pathology.

A diverticulum of the ureter rarely causes obstruction; the author saw one in a girl, aged four. The sac may form primarily as an accessory ureteral bud or secondarily as a blow-out consequent to distal ureteral blockage. It may compress the ureter with proximal dilatation or perpetuate an established urinary infection ("chronic pyelitis"). Such sacs are demonstrable by ureterography and are best excised.

Torsion of the ureter occurred twice in 12,080 autopsies in children; it results from failure of the ureter to rotate with the kidney. Twisting of the duct produces obstruction. There is no record of its identification in the living.

Abnormal insertion of the ureter high in the renal pelvis produces a spur valve blockage; it may result from renal rotation downward and inward, and from hydronephrosis.

Ectopic ureteral orifices are more often abnormally dilated than constricted. When constricted, the treatment is that of a ureterovesical junction stricture. Often ureteronephrectomy or ureteroheminephrectomy is necessary.

Extra-ureteral pressure from aberrant vessels, tumors, cysts, enlarged lymph glands, and adhesions must be treated according to the local pathology. In about half the cases of vascular blockage, division of the obstructing vessels suffices.

Ureteral stone in children usually manifests the same symptoms as in adults. So-called intestinal colics are often ureteral colics. The stones are often radiopaque (composed of uric acid) and are demonstrable as negative shadows. Ureteral dilatation encourages the passage of small stones. With impassable stone or with infection and advanced upper-tract dilatation, ureterotomy is indicated unless advanced disease demands nephrectomy.

Inasmuch as infection is the most important complication, the instrumental treatment should be supplemented by vigorous chemotherapy. The author's first choice is ammonium mandelate together with ammonium chloride to insure adequate acidity. Instrumentation is preceded by antiseptic treatment for from three to six days. The second choice is sulfanilamide. No patient is pronounced cured of infection until 2 sterile cultures of aseptically collected urine have been obtained.

LOUIS NEUWELT, M.D.

Rudnick, D. F., and Cornell, E. F.: Clinical Manifestations of Stricture of the Ureter in Women. *J. Urol.*, 1939, 41: 679.

Thirty-eight cases of ureteral pain, in which stricture of the ureter was demonstrated in 34 and ureteritis in 31, are reported by the authors. The symptoms of abdominal or lumbar pain, or discomfort are frequently periodic and are often associated with menstruation; vesical symptoms were not prominent.

The authors claim that the diagnosis is suspected on finding ureteral tenderness during vaginal palpation and confirmed by cystoscopic and urographic examination. Dilatation of the stricture to No. 10 F is advocated by the authors, and it was found that one dilatation was sufficient in 75 per cent of their cases. D. E. MURRAY, M.D.

BLADDER, URETHRA, AND PENIS

Bailey, H.: Reconstruction of the Deep Urethra. *Brit. J. Urol.*, 1939, 11: 111.

When a complete intrapelvic rupture of the urethra occurs, in addition to a fractured pelvis and avulsion of the membranous from the prostatic urethra, the puboprostatic ligaments are torn, which permits the unanchored bladder neck to rotate backward. This is aided by the dorsal decubitus plus the accumulation of blood and extravasated urine in the space of Retzius. Unless properly treated a hopeless stricture is formed.

The author reports the case of a boy, nineteen years of age, who had sustained a fractured pelvis complicated by an intrapelvic rupture of the urethra. Because of several other injuries all that could be done at once was a suprapubic cystostomy. Seven weeks later the diagnosis was verified by the cystogram and this showed a gap of an inch between the severed ends of the urethra.

An incision was made in the perineum. Beneath the pubic arch a considerable amount of callus was encountered and this was picked away. A sound was introduced into the suprapubic sinus to assist in the location of the apex of the prostate. A gum-elastic catheter was then passed from the external urinary meatus through the urethra and out through the proximal portion of the urethra. The bulb of the corpus spongiosum was dissected from the corpora cavernosa. The flaps hinged toward the free end were then cut from the floor of the urethra. These flaps contained the whole thickness of the bulb. The right flap was sutured to the roof of the free end of the prostatic urethra and the left flap was similarly fixed, partly overlapping the first. No attempt was made to close the floor. The wound was packed lightly with gauze soaked in flavine. A de Pezzer catheter was placed in the suprapubic wound.

On the twelfth day, under gas anesthesia, a No. 10–12 Lister sound was passed from the meatus into the bladder. The tip of the metal sound had been drilled and via the drill-hole a piece of silk was insinuated along the whole course of the urethra. By means of the silk a catheter was introduced from the bladder to the meatus, and it was subsequently changed by the railroad method. The perineal wound took weeks to heal.

At the present time, one year after the accident, the patient, who has had complete loss of the compressor urethra, has no control and is obliged to wear a portable urinal. Later an attempt will be made to construct a sphincter by means of a graft of the gracilis muscle. The patient is obliged to wear a urinal, although he is well and active with complete healing of the suprapubic wound.

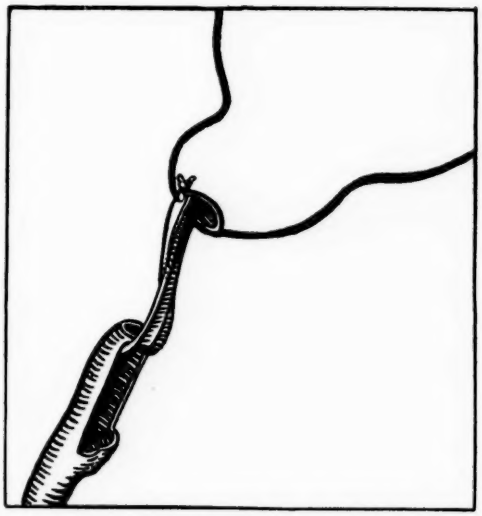

Fig. 1. A similar flap is cut from the left side of the floor and the free extremity of each is sutured to the apex of the prostate, slightly overlapping one another.

ELMER HESS, M.D.

GENITAL ORGANS

Bluemel: The Results of Transurethral Resections of the Prostate in Prostatic Hypertrophy (Die Ergebnisse der transurethralen Prostataresektionen bei Prostatahypertrophie). *Zentralbl. f. Chir.*, 1938, p. 2683.

Among 214 patients with prostatic disease, there were found 164 with benign hypertrophies, of which 65 were treated by suprapubical prostatectomy, 59 by transurethral resection, and 40 were treated conservatively. The contraindication to suprapubic prostatectomy constituted the indication for transurethral resection. This method was used, therefore, from the beginning, only in the more unfavorable cases. Of the patients so treated, 10 died in the hospital after a more or less prolonged time, and the death of 4 of these with certainty cannot be attributed to the operation. Of the 6 others, 2 died from an injury of the membranous portion of the urethra, and 4 showed phlegmons of the bladder wall with pyelonephritis. The function of the bladder was good on dismissal from the hospital in the other patients operated upon.

Information was obtainable later from 47 patients; 11 had died, and of 12 who gave information in writing, 1 complained of cystitis, 1 catheterized

himself, and the others were free from symptoms. Twenty-seven patients could be followed up and had more or fewer symptoms.

In view of the fact that operation was carried out only in patients who would otherwise have had to be catheterized permanently or on whom a bladder fistula would have had to be made, the result must be considered as satisfactory.

(Von Tappeiner). Louis Neuwelt, M.D.

Belt, E., Ebert, C. E., and Surber, A. C., Jr.: A New Anatomical Approach in Perineal Prostatectomy. *J. Urol.*, 1939, 41: 482.

The authors present a technique for perineal prostatectomy, with illustrations and general operative results.

A curving transverse perineal incision 1½ cm. from the anal mucosa exposes the delicate fibers of the median raphe. These are cut, and the arching fibers of the external rectal sphincter are revealed; these are raised to disclose the longitudinal muscle layer of the rectum. The anal canal and rectum are depressed and pushed backward, to define the central tendinous plane of the perineum. The areolar tissue and tendinous portion of the recto-urethralis muscle, joining the rectum to the base of the perineal membrane, are snipped through, which reveals the anterior free borders of the levatores ani and the flat sheath of the recto-urethralis. The recto-urethralis is split medially and retracted laterally with the levatores ani, which exposes the tough, white, shining fascia of Denonvilliers covering the posterior surface of the prostatic capsule. By use of the cleavage plane present between the external sphincter ani and the longitudinal muscle fibers of the rectum, therefore,

Fig. 1. Finger in cleavage plane between external sphincter ani muscle and rectum.

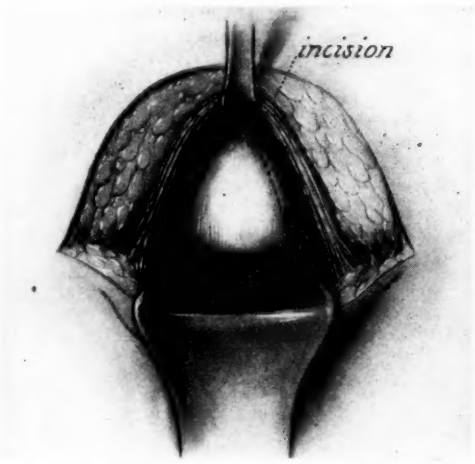

Fig. 2. Levator ani muscles pushed laterally; rectum eased backward. Posterior surface of prostate exposed. Dotted line marks incision through capsule.

the capsule of the prostate is exposed bloodlessly and without section of a nerve.

Sidney J. Ritter, M.D.

Wessel, E.: The Results of Operative Therapy in Cryptorchids (Ergebnisse operativ behandelter Kryptorchen). *Deutsche Ztschr. f. Chir.*, 1938, 251: 235.

The newer conceptions of the genesis and hormonal relationships of cryptorchidism have crowded somewhat into the background the purely technical aspect of its surgery. It is now generally accepted that it is expedient to classify patients with this condition into two distinct groups: those afflicted with purely anatomical anomalies, such as failure of testicular descent owing to distortions or adhesions; and those in whom endocrine abnormalities are readily demonstrable. The bilateral cases very definitely belong to the second group; without a doubt, endocrine therapy alone will bring about the descent of the testes. Perfect results are reported following this treatment by reliable observers. The grafting of hypophyseal tissue also appears to be successful.

The indication for operative procedures, consequently, depends upon the group in which the patient belongs. The best period for operation is between the ages of eight and eleven years. A bilateral operation should be undertaken only when an endocrine disturbance is ruled out. In other cases hormonal treatment should be instituted, and only after it has failed should an operation be performed. Careful consideration should be accorded the advice to treat the children who have been operated upon with hormonal methods following the operation.

The author conducted a follow-up examination of 56 cryptorchids operated upon in the Sauerbruch Clinic in the last ten years. This was done, not only for checking the position of the replaced testes, but also to note their size and the developmental proportions of the entire body. The detailed results, which are partially tabulated, should be read in the author's original paper. Nothing could be definitely asserted in this series of cases regarding the generative powers of the organ; the patients should be subjected to further observation relative to this question. In nearly all of the patients the operation promoted the growth of the testes, and because of that development, the growth of the entire body was improved. (Roedelius). Mathias J. Seifert, M.D.

Imbert, M.: Rapid Cure of Acute Orchi-Epididymitis by Injection of Novocaine into the Vas Deferens (Guérison rapide des orchi-epididymites aiguës par des injections déférentielles de novocaïne). *J. d'urol. méd. et. chir.*, 1939, 47: 177.

In orchi-epididymitis resulting from gonorrhea or other infection, Imbert has found that pain is often severe and is not relieved by the usual methods of treatment. In orchitis and orchi-epididymitis, there is an active inflammatory process, and the condition is not unlike that observed in sprains. In the latter Leriche has advocated the local infiltration of novocaine. The author, therefore, determined to use a similar method of local nerve blocking of the nerve terminations in the region of the vas deferens. The arteries of the testicle, the epididymis, and the vas deferens are richly supplied with sympathetic nerve plexus and when novocaine is injected the sympathetic reflexes and the resulting vasomotor reactions are interrupted. A long fine needle is used, and a 1/100 solution of novocaine; from 10 to 15 c.cm. of this solution are injected. As a rule a single injection is sufficient to relieve the pain; if not, the injection may be repeated on the following day.

The author has treated 15 cases of acute orchi-epididymitis due to gonorrheal infection, 1 of these with bilateral involvement, by novocaine infiltration. The pain was entirely relieved in an average of thirty hours; the inflammation subsided in an average of fourteen days. In 1 case of orchi-epididymitis due to colon-bacillus infection, pain was relieved in three days; recovery was complete in twenty days; but in this case there was a septicemia which delayed recovery. In 7 cases of orchi-epididymitis due to various types of urinary-tract infection (1 with bilateral involvement) the pain subsided in an average of twenty hours, and the inflammation was relieved in an average of three days and four hours.

In all cases of orchi-epididymitis, the primary infection should be treated as usual; the author has found vaccine treatment of value in gonorrheal infections. The chief effect of the novocaine infiltration is to relieve the pain; it also relieves the swelling, edema, and inflammation of the tissues, and shortens the period of hospitalization.

Alice M. Meyers.

MISCELLANEOUS

Thomson, D. L.: The Relations Between Endocrinology and Urology. *J. Urol.*, 1939, 41: 435.

The author does not attempt to cover all of the topics which the title suggests.

The growth of the prostate, normal or abnormal, depends on the prostate's being constantly irrigated with blood containing the testicular hormone. It seems logical that when involution is desired it can be achieved by castration. At one time this heroic measure enjoyed a certain vogue, but in this generation less drastic measures are used. The most obvious of these is the administration of female sex hormones (estrogenic substances).

The hormones characteristic of the male and female sexes are extremely similar substances; the two most important physiologically (estradiol and testosterone) differ only by 1 carbon and 6 hydrogen atoms. Every individual, whether male or female, possesses both estrogenic and androgenic hormones, though sex may determine which predominates. Nevertheless, though we no longer think of the male and female hormones as actively antagonistic or incompatible, it might theoretically be possible to inhibit the growth of the prostate by administering estrin (theelin), for this will curb the activity of the anterior pituitary gland, and the lack of its stimulus will depress testicular function; therefore the development of the prostate will be retarded. On the other hand, most endocrinologists regard estrogenic substances not as a possible means of cure, but rather as a probable cause of prostatic hypertrophy, and reference is made to the studies in animals with the estrin treatment. There are, however, objections to the view that estrogenic substances are the cause of prostatic hypertrophy. It is not certain that the estrogenic substances occurring in the male body are the ones used by these experimenters, and many of these workers were unable to find evidence of unusual quantities of estrin in sufferers from prostatic enlargement, although biological assay is uncertain in these determinations. The author states that it will be extremely difficult either to prove or to disprove the hypothesis that estrogenic substances cause so-called "spontaneous" hypertrophy of the prostate.

On the other hand, other experimenters in the hope of re-establishing the endocrine balance of youth have treated prostatism with testosterone propionate (the most potent androgen available). They believe that just as estrogens have a general tendency to produce squamous metaplasia, so androgens have a tendency (well seen in the reaction of the capon's comb, the standard test-object for these hormones) to produce a mucoid edema. This they regard as characteristic of the healthy prostate and as a preventative of spasm of the urethral sphincter, for they believe that spasm, rather than passive obstruction, is the cause of dysuria and retention. Similar ideas underlie the proposal to treat prostatism by the Steinach operation of ligation of the vasa efferentia between the testes and the epididymides;

this procedure is supposed to stimulate the testes to produce larger quantities of its hormones, though few physiologists believe that it does so and that it seems a slender chain of reasoning to justify a serious and sometimes dangerous operation.

The last view which the author mentions is the belief of some experimenters that the testis may produce, in addition to the well known fat-soluble testosterone and its allies, a water-soluble principle called "inhibin" or "contruin" which serves especially as a check upon the anterior pituitary lobe. They believe the production of inhibin is decreased with age, and accordingly have treated prostatic hypertrophy with testis extracts supposed to contain this hormone. The author is, however, not yet convinced that there is any such substance as inhibin and is unable to regard the clinical results as decisive.

The interrelations between the different members of the endocrine system are so complex, and the parallelism between the experimental animal and the clinical case so untrustworthy, that it is possible to construct a fairly plausible theoretical argument in favor of almost any form of endocrine treatment (direct or indirect) which it may seem desirable to introduce. Thus, each of these 3 proposals for the endocrine treatment of prostatic hypertrophy: the estrogenic, the androgenic, and the inhibin methods, has its supporters both in theory and practice. More unbiased, well controlled clinical studies are required, before the adoption or discard of any one of these suggestions, and investigation may very well show that prostatic patients can be subdivided into different categories, for each of which there is an appropriate medical or surgical treatment.

The author states that some at least of the difficulties of the subject discussed depend on the fact that the so-called male and female hormones are not sharply differentiated, but are somewhat alike both in chemical nature and physiological properties, and that the situation is even more complex, in that account must be taken, not merely of the ovary and the testis, but also of the adrenal cortex. Mention is made by the author of the striking results of a long series of biochemical researches concerning new adrenal substances.

In chemical structure and properties, these new hormones and hormone-like substances may be regarded as intermediate between progesterone of the corpus luteum, and testosterone or other androgens; in their physiological properties, they overlap these well known substances, although some of them appear to be inactive, and others have the specific properties of the life-maintaining hormone of the renal cortex itself.

Tumors of the renal cortex lead to virilism or even pseudohermaphroditism in females, or to feminizing tendencies in male subjects. Convincingly clear-cut connections between the adrenals and secondary sexual characters have been established and it is acknowledged that the adrenal cortex contains substances with androgenic properties. These substances are excreted in large amounts by many women who display virilism, more especially when there is an actual adrenal tumor. Chemical investigation has cast some light on these problems, and the adrenal gland must be regarded as capable of influencing secondary sexual characters. It is well to remember that the cortex itself is rather differently developed in the two sexes.

The adrenal cortex may seriously affect the reproductive system; yet its main function is another and a more vital one. Life under normal conditions and on normal diets at least is impossible in the continued absence of the cortical hormones. The exact manner in which they function remains disputable, but most physiologists are agreed that in some way they control the movements of the mineral elements, sodium and potassium. (Whether their other effects, for example, on the carbohydrate metabolism, are secondary or independent, it is not yet possible to say.) In the absence of these hormones, the body tends to waste its store of sodium, and unduly to conserve its store of potassium, so that, in the adrenalectomized animal or in the sufferer from Addison's disease, potassium salts are dangerous while an ample supply of sodium salts is of the greatest value. It may be that the kidney has a part to play in regulating the excretion of sodium and potassium, under the control of the cortical hormones; and it is certain that even in the early stages of adrenal deficiency the blood urea tends to rise, while in later stages there may be complete circulatory and renal failure. It would be going much too far to regard the kidney as the only organ directly affected by the hormones of the adrenal cortex, or to assume that the adrenal gland governs the fluctuations in renal activity from hour to hour. For such direct endocrine control of the kidney, we must look elsewhere: to the posterior lobe of the pituitary body. It has long been known that it contains some of the most potent principles known to pharmacology, capable, for instance, of elevating the blood-pressure by capillary constriction; of causing powerful (and sometimes useful) contractions of the uterine muscle; and, under certain circumstances, of strikingly inhibiting the secretion of the urine. Yet it has not been easy to show, and it would be rash to assume, that these principles ever escape from the gland in which they are found, or ever play a part in the physiological regulation of the body.

Within the last few years, with advancing knowledge, it has become almost certain that the activity of the kidney is controlled from hour to hour by the pituitary anti-diuretic hormone. Richter showed in the rat that removal of the posterior pituitary lobe alone produced a permanent diabetes insipidus; if the anterior lobe is also removed, however, there is a cancellation of the effects and no permanent polyuria results.

Rydin and Verney have recently re-studied the well-known fact that urine secretion is somewhat inhibited in muscular exercise or in emotional states: they developed a cannula technique by which

they could follow the activity of the dog's kidney, without anesthesia, from minute to minute, and they found that exercise and alarm or anger caused a prompt cessation and gradual resumption of the secretion of the urine. The curve of response was unaffected by denervation of the kidneys or inactivation of the adrenals, and was exactly the same as the curve obtained when extracts of the posterior pituitary lobe are injected. It would be interesting to make similar experiments on hypophysectomized dogs, though it is difficult to remove the whole posterior lobe in this species. It seems that the activity of the posterior lobe in governing the kidney can itself be controlled through nervous stimuli, and probably also through chemical stimuli. It has previously been suggested that a hyperactive posterior pituitary lobe produces the symptoms of eclampsia, but the evidence on which this theory is based has been subjected to very destructive criticism: it does not seem probable that the posterior lobe could long maintain an elevated blood pressure in human beings without other symptoms dominating the picture, and the nearest experimental approach to hypertension as it is seen in the clinic is along quite different lines. These lines, however, are of considerable and direct interest to urologists; the experiments of renal hypertension referred to are those of Goldblatt, Lynch, Hanzal, and Summerville. These workers showed, in the dog, that if the blood supply to the kidneys is reduced by the application of constrictive clamps to the renal arteries, there follows a rise in the blood pressure which may be maintained for months or even years. The result of applying this treatment to one kidney, when the other is removed, is the same: yet in neither case is it necessary or even usual that excretory function be seriously impaired. It is thus possible at will to produce either a chronic or a malignant hypertension.

One would be tempted to interpret the rise of blood pressure following renal ischemia as an attempt to maintain normal blood flow through the kidneys in spite of the obstruction, and to regard the phenomenon as a reflex. However, it has been shown that denervation of the kidneys does not interfere with the response. If the nervous system is not involved, one must search for a humoral agent as the cause of the increased blood pressure; but there is no evidence of increased adrenaline secretion, and inactivation of the adrenal medulla has been found to have no effect.

So many possibilities are excluded by the work outlined, that only one plausible theory remains: that the ischemic kidney itself produces a pressor substance; that it elevates the blood pressure without diminishing the blood flow through the peripheral tissues or causing a fall of the skin temperature, and thus reproduces the conditions actually observed in typical clinical hypertension. There is evidence that unusually large quantities of this pressor substance are found in the ischemic kidneys of dogs subjected to Goldblatt's procedure and in the kidneys of human subjects with hypertension. It is still impossible to say to what extent clinical hypertension is due to this newly-discovered mechanism (as it is also impossible to say why ischemia provokes the kidney to the continuous production of the pressor substance); however, the demonstration that the kidney may be the primary origin of the factor responsible for hypertension must vividly stimulate the imagination of all enterprising urologists.

C. TRAVERS STEPITA, M.D.

Millin, T.: Some Observations on the Surgical Treatment of Urinary Incontinence. *Proc. Roy. Soc. Med.*, Lond., 1939, 32: 777.

The author classifies the types of true incontinence amenable to direct surgical repair as follows: (1) epispadias; (2) aberrant ureteric orifice; (3) acquired fistulas either following childbirth or surgery; (4) congenitally absent sphincteric mechanism; and (5) acquired deficient sphincteric mechanism following childbirth or surgery.

The success of direct surgical attack upon epispadias depends upon extensive freeing of the vesical neck beneath the pubic band, and by a rather tight reconstruction of the vesical sphincter. The sutures placed beneath the pubic band and along the corpora cavernosa may have a tendency to shut off the blood supply of the corpora cavernosa and glans penis; these must be watched carefully.

The author has observed only 2 cases of aberrant ureteric orifice. The first case was that of a girl, aged twenty-four, suffering with incontinence since birth. Urethroscopy revealed an opening in the floor of the urethra just below the bladder neck. The right kidney was filled with stones. A nephrectomy cured the incontinence. In the second case the ureter opened into the prostatic urethra.

Seven girls, aged from five to twenty-one years, all virtually completely incontinent, showed a patulous outlet near the bladder neck and were operated upon with most gratifying results. In view of the youth of the patients and the smallness of the vagina, a transvesical approach was used. Suprapubically, the internal meatus showed a widely open sphincter and the upper urethra was stretched digitally to facilitate removal of part of the floor. A wedge was then resected from the bladder neck posteriorly, the lateral incisions being carried down into the urethra as low as possible. A series of transverse sutures were then introduced, and the urethra and bladder neck tightened about a No. 4 F. rubber catheter. When the sutures were tied, the catheter was removed and the bladder closed about a Pezzer tube or about a double suction tube. Suprapubic drainage was maintained for ten days, when the fistula was allowed to close. While the tube was in position, no bladder lavage was employed, merely the daily instillation of 2 drams of 2 per cent mercurochrome or 1/2,000 acriflavine. In every case the ultimate functional result was perfect.

The author believes that the majority of vesicovaginal fistulas should be attacked through the

bladder. As the leakage is essentially from the bladder into the vagina, it is all-important to secure a watertight closure at the entrance of the fistula, i.e., at the vesical end. A careful freeing of the edges of the fistula with undermining of the muscularis, followed by suturing of the connective tissue between the bladder and vagina, and finally a continuous suture of the bladder wall and mucosa, should rarely, if ever, be followed by failure. A boomerang needle is almost indispensable. A diversion of the urine is necessary, and the use of the double-suction suprapubic tube for from ten to fourteen days is best. Ureterocervical, ureterovaginal, and ureterocutaneous fistulas require anastomotic repair or nephrectomy, according to the degree of infection, the amount of pelvic dilatation, and the time which has elapsed since the fistula has developed.

Stress incontinence following childbirth is particularly amenable to careful suturing of the periuretral tissues in most cases. Cystoceles may be grouped as follows: (1) those anterior to Mercier's bar; (2) those posterior to Mercier's bar, and (3) the combined types. The first group may be further subdivided into (a) those with normal fixation of the vesical neck and the formation of a pouch between the sphincter and the interureteric bar, and (b) those with dislocation of the bladder neck and urethra and descent of the trigonal muscle as a whole together with the bladder neck. By means of cystourethroscopy and cysto-urethrography these types can be differentiated and the appropriate suprapubic operation can be planned—either ventrifixation of the bladder (Bonney), a Goebell fascial sling about the bladder neck, or the plastic procedure on the vesical outlet as described for congenital incontinence.

Incontinence in males, excluding that of neuropathic origin, is usually the result of surgery, usually perineal prostatic surgery. Transurethral resections may be followed by this complication when the verumontanal landmark is overlooked and the external sphincter inadvertently resected. Many operations have been suggested, but the ideal one has not yet been found. These operations are based on the theory that the difference between complete incontinence and complete dryness is not the difference between a widely open tap and a tightly closed one, but rather the difference between a tap that drips slightly and a tightly closed one. One may expect, therefore, at least in some cases, to close such a dripping urethra by relatively slight or indirect pressure. The operations may be roughly divided into 2 groups: (1) those aiming at a decrease of the caliber of the urethra by a plastic procedure causing external compression of the canal, and (2) those consisting of actual removal of tissue, usually a wedge at the vesical neck (Young) or the roof of the urethra (Lowsley). The operations aiming at the substitution of another muscle for the deficient sphincter really fall into the first group because external compression of the urethra is thereby obtained. A large number of muscles have been used for this purpose, mostly the pyramidalis together with a strip of the rectus sheath (Goebell-Frangenheim-Stoeckel), and the gracilis (Giordano, Deming, Player, and Callender). Lowsley has proposed plication of the bulbocavernosus muscle with ribbon catgut.

The following operation is described by the author:

A No. 20 F. sound is passed down the urethra to the bulb, and held in the midline by an assistant. A median incision is then made from the root of the scrotum to the central point of the perineum, and carried through Colles' fascia. Blunt dissection exposes the bulb covered by the bulbocavernosus muscle, the ischiocavernosi, and the inferior layer of the triangular ligament. The perineal arteries may or may not be ligated. The bulbocavernosus muscle is then divided along the median raphe, and the two halves of the muscle are drawn laterally. Scissor dissection then separates the corpus spongiosum with the cavernous urethra from its relatively loose attachment to the triangular ligament until the corpus spongiosum is free posteriorly from the point where the urethra pierces the triangular ligament, anteriorly to the union of the spongiosum to the corpora cavernosa. Two fingers are easily passed beneath the corpus spongiosum. Ribbon catgut is then passed twice around the spongiosum, and tied rather firmly over the urethra still embracing the sound. This suture should be placed as far back as possible, close to the site of the faulty external sphincter. The bulbocavernosus muscle is then, by means of the ribbon catgut, sutured snugly about the corpus spongiosum, the sound is withdrawn, and a well lubricated rubber catheter, size 18 F., is passed into the bladder and fixed to the glans penis with a silk-worm stitch. Colles' fascia is closed with a continuous No. 0 catgut stitch, and the skin closed with silkworm gut without drainage. The catheter is left in for ten days. While the catheter is *in situ* the usual bladder lavage and oral antisepsis are employed. LOUIS NEUWELT, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Ducroquet and Cottard: Congenital Pseudarthrosis of the Extremity. Bone Deformity in Neurofibromatosis (Pseudarthrose congénitale de jambe. Déformation osseuse de la neurofibromatose). *J. de chir.*, 1939, 53: 483.

Of obscure origin and disputed pathogenesis, pseudarthroses and deformities of the limbs may be grouped among the trophic bone disturbances. There is a marked familial tendency toward these conditions; and the roentgen rays show lesions of two bones of the same extremity ranging from mild deformities to severe and marked disturbances. The deformity is characterized by an interno-anterior convexity at the height of the pseudarthrosis. Whether the lesions are stationary or evolve slowly or rapidly, there is no spontaneous tendency toward cure.

In 10 of 11 cases observed since 1934 the authors were able to find neurofibromatosis in latent or manifest form in the patient or his family. In the 1 exception there was an incomplete family history; and the authors raise the question whether or not it was an isolated case of neurofibromatosis in the third or fourth generation. Eleven cases are reported, the patients varying in age from two to sixty-five years. There are numerous photographs and roentgenograms. In 8 of these cases there was a co-existence of the bone lesions with neurofibromatosis. In 1 there was co-existence of congenital bone deformity with typical clinical neurofibromatosis. In 3 of 5 instances there was observed in 1 of the parents the pigmentary form and in 2 the typical clinical form of neurofibromatosis. In perusing the world literature the authors found the association of neurofibromatosis with bone lesions in 20 of 21 cases.

The recognition of a pigmentary "forme fruste" throws new light on a group of congenital bone deformities with puzzling evolution and manifestations, and explains them by a common origin. There are two categories of lesions: bone lesions, and neurofibromatosis. There is an interesting illustration of the occurrence of scoliosis associated with neurofibromatosis in a grandmother, mother, and daughter. Another case was that of a twelve-year-old girl with hemiplegia and associated skin pigmentations. At operation a neurofibroma was found in the rolandic zone, and the father was found to be covered from head to foot with fully developed neurofibromatosis. Blood examinations demonstrated a mild hypercalcemia both in neurofibromatosis and in the bone deformity cases.

The authors conclude that there is a relationship between Recklinghausen's neurofibromatosis and the bone deformities mentioned. The authors ascribe the pathogenesis of the bone lesions to deficient vascularization due to endocrine dysfunction and disturbance of the trophic nerve centers. Some suspect that the hypophysis cerebri is at the bottom of the disturbances in neurofibromatosis. Microscopic examination of the bones has shown a thickened and fibrous periosteum with complete disappearance of the lumen of the medulla. Roentgen rays show the deformities and bone lesions described by Recklinghausen under the name fibrogeodic osteitis. There are accessory findings similar to those of Paget's disease, such as thickening and sponginess of some of the bones, particularly of the skull.

Surgery is uncertain in its results. Camurati treated 27 cases with only 5 good results; Putti, 13 cases and Froelich, 4 cases with 1 good result for each; and Henderson, 19 cases with 5 good results. The function of the limb is preserved until a far advanced stage of the bone lesion with the aid of suitable orthopedic appliances. The trophic changes in the bone ameliorate with age; the later a child is operated upon the better the results. Prudence is required in surgery until signs of osseous and muscular improvement are noted. The obstetrician is cleared of any responsibility in congenital bone lesions associated with neurofibromatosis.

JACOB E. KLEIN, M.D.

Ghormley, J. W.: Bursitis. *Am. J. Surg.*, 1939, 44: 282.

In this clearly presented article on bursitis, the subject is divided into two parts, the first being a

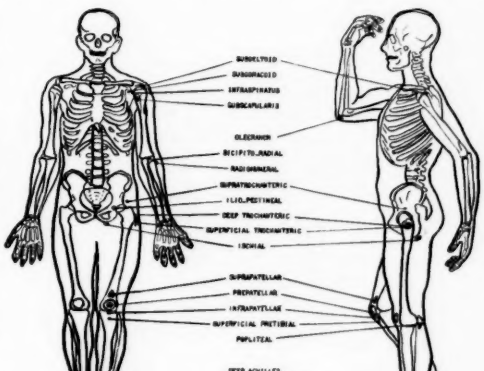

Fig. 1. Diagrammatic representation of the important bursæ of the body. (Courtesy of Am. J. Surg.)

general discussion and the second a description of the lesions of the individual bursæ in the different parts of the body. The pathological changes in the common types of bursitis, including the acute traumatic, chronic, calcified, and pyogenic, are outlined briefly. The author advises conservative therapy in all types except the pyogenic. Most of his cases of acute subdeltoid bursitis responded best to rest and short-wave diathermy. Aspiration is indicated when fluid is present, and surgery is performed only when conservative measures fail. Ghormley adds a word of caution against the indiscriminate excision of bursæ, as they often act as essential pads or lubricating sacs.

All the bursæ of the body are illustrated clearly on a diagram of the skeleton. An excellent bibliography is appended. DANIEL H. LEVINTHAL, M.D.

Bennett, G. E., and Cobey, M. C.: Hemangioma of the Joints: Report of 5 Cases. *Arch. Surg.*, 1939, 38: 487.

The authors report 5 cases of hemangioma of the knee joint which were diagnosed and treated by themselves, and review 25 authentic cases reported in the literature.

The authors' patients were 3 girls and 2 boys. The age of onset of the condition varied from eighteen months to eighteen years, and the duration of symptoms from ninety minutes to eight years. Trauma was not a factor. Swelling was present in all of the cases, with pain and recurring attacks of limp and pain on motion in 4. The palpable elastic, spongy mass, compressible and distensible, was evident in only 2. There was tenderness in 2. Muscular atrophy and crepitation were present in only 1 case. Two of the patients received no treatment before operation; 2 were treated with rest in bed; and 1 was treated with bandages and casts. The roentgenograms throughout failed to show any abnormality except for erosion of the cartilage in 1 case. In the first case complete excision was attempted, but hemorrhage and infection followed, and finally amputation had to be performed. Complete excision was possible in only 1 case, in which the tumor was pedunculated. Biopsy followed by radium or roentgen therapy was carried out in the other 3 cases, with practically complete recovery. The final diagnosis of hemangioma was made and verified by histological study in the first 4 cases. The sign, symptoms, and course made the diagnosis certain in the last one.

Surgical excision was the method of treatment used by the other authors, but this was successful only in cases in which a pedunculated, encapsulated tumor and a small synovial or capsular lesion was present. In 6 of the 24 cases a second operation was necessary for removal of the major part of the tumor and for control of hemorrhage. Complete recovery was reported in 11 cases.

All the cases presented the same striking cardinal signs. They are pain and intermittent swelling since early life, with slight limitation in extremes of motion. The swelling, which is present about the patella, disappears on elevation of the extremity. There is no marked increase in local heat and usually no cutaneous discoloration. The swelling is boggy, almost fluctuant. Occasionally there is a clicking sensation in the knee. Pain is never constant but is occasionally associated with the swelling. Motion of the joint is usually free and painless. Roentgen-ray studies are usually negative. Blood can be aspirated from the joint.

The relative early appearance of the tumor and its close association with telangiectasis and various other types of hemangioma, as found in the skin, muscle, spine, tendon sheaths, and other structures of the body, suggest a congenital origin. The variations encountered are due to the stage of vascular development to which deviation from the normal occurred.

The pathological picture was typical cavernous hemangioma, presenting irregular, blood-filled areas separated by serpentinous spongy, thin-tissue septums. No malignant changes were reported.

The earlier the treatment is given, the more satisfactory the result. The tumor may take one of three forms: diffuse, pedunculated, or encapsulated. In any case it may remain stationary, regress in size, or grow very rapidly at any time or age of the patient without apparent cause. For the small pedunculated tumor the treatment is complete excision. Because of the almost uncontrollable hemorrhage with the danger of loss of function of the joint, and the fact that amputation or infection may be followed by septicemia, the authors believe that a larger non-pedunculated tumor is more satisfactorily treated by rest and radium or roentgen therapy. F. HAROLD DOWNING, M.D.

Racugno, L.: Late Results of Surgical Orthopedic Treatment of Spastic Paralysis of Infancy (Risultati a distanza della cura chirurgica ortopedica nelle paralisi spastiche dell' infanzia). *Minerva med.*, 1939, 30: 206.

From 1920 to 1934, 124 spastic children were treated at the Regina M. Adelaide Institute of Turin; 72 had Little's disease, 12 spastic diplegia, and 40 spastic hemiplegia. After the surgical orthopedic treatment, all children were followed up for several years for the purpose of functional re-education. Racugno was able to trace 74 of the patients and reports the late results obtained by the combined treatment.

Of the 72 children with Little's disease, 42 were traced and of these, 32 had been treated by plastic lengthening of the Achilles tendon, followed by immobilization of the foot for two months, while 10 had been treated by subcutaneous tenotomy of the Achilles tendon with immobilization of the foot in slight equinus for two weeks, followed by final correction after cicatrization of the tendon. Examination from three to sixteen years after the intervention showed 21 good, 10 mediocre, and 11 bad results. The difference in results depended mostly on

the degree of the disease, the intelligence of the patient, and the persistence of the parents in following for years the functional re-education program which is the indispensable requirement to obtain a good result. The result is considered good when the patient is free from defective posture and succeeds in walking securely by himself, although his gait may be somewhat strange. Bad results with any kind of treatment are unavoidable in patients with serious diffuse lesions of the extrapyramidal tracts and of the intellectual centers.

Any kind of treatment has proved useless in tetraplegic patients with pronounced changes in the anterior zones of the brain and in the central nuclei (pallidostriate system). In 2 patients of some intelligence with a moderate spastic syndrome of the lower extremities and a slight syndrome of the upper extremities, erect posture and walking was made possible, while in 2 children of four years, with normal mentality and the syndrome of simple congenital rigidity, there was a spontaneous tendency to regression.

The best cases for surgical orthopedic treatment were those in which the disease was limited to the lower extremities and the mentality was little or not at all affected. Good results were obtained by lengthening of the tendons and myotomy in equinus of the foot, flexion and adduction of the thigh, and flexion of the knee, due especially to muscular retraction. These simple operations eliminated the obstacles to erect posture and moderated the spasm, and thereby made possible the execution of exercises apt to influence the re-education of the cortex. In spastic patients with severe muscular spasm, the results were poor or negative, but better and more lasting results were obtained with neurectomy, associated or not with lengthening of the tendon. In a case of severe equinus due more to muscular spasm than to contracture, posterior arthrodesis gave a permanent result.

Of the 40 patients with spastic hemiplegia, 22 were operated upon, 10 were treated by hypercorrection in a plaster cast left on for four or five months, followed by the use of a retention appliance at night and functional re-education, and 8 were given medical treatment and re-education. Results were satisfactory in the last 18 patients. In the cases operated upon, in which the equinus had to be corrected, notable improvement in walking was obtained by lengthening of the Achilles tendon; on the other hand, little was gained by surgery supplemented by orthopedic measures in the upper extremity, in which motor re-education is more difficult because of the complexity of the movements to be executed. However, section of the epitrochlear process of the humerus with its muscular insertions, associated with arthrodesis of the wrist with slight extension of the hand, gave moderate use of the arm and caused esthetic improvement in a patient with flexed and pronated forearm and flexed hand and fingers due to shortening of the extensor tendons.

RICHARD KEMEL, M.D.

Glatthaar, E.: The Pathology of Humeroscapular Periarthritis (Zur Pathologie der Periarthritis humeroscapularis). *Deutsche Ztschr. f. Chir.*, 1938, 251: 414.

The investigations of humeroscapular periarthritis by Schaer have shown heavy areas of calcification over the greater tuberosity of the humerus near the insertions of the tendons of the supraspinatus and infraspinatus muscles. Involvement of the subdeltoid bursa is a secondary phenomenon. Humeroscapular periarthritis and calcareous subdeltoid bursitis should no longer be grouped under one head. Seldom are the changes of humeroscapular periarthritis observed before thirty years of age; they are found occasionally between the ages of thirty and thirty-five years and from then on with an increasing frequency, which reaches a maximum in old age.

A correlation between vascular disease and periarthritis cannot be demonstrated. On the contrary there is a definite association between the changes of periarthritis and those of arthritis deformans. Both conditions frequently start at the same point, specifically in the ligamentous portions of the joint near the tendon attachments. Fraying apart of the cartilaginous attachments of the tendons (raveling tendon rupture) usually occurs ten years earlier than the similar process in the joint cartilages. A causal relationship also exists between arthritis deformans of the intertubercular sulcus and the splitting up of the connective tissue and shredding of the fasciculi of the long head of the biceps tendon. According to this study, then, humeroscapular periarthritis is not to be regarded as a distinct disease but rather as a sequence of events in the widespread physiological aging process of the whole body. Such a conception implies a new viewpoint toward compensation in these cases. (GROSS). AUGUST JONAS, JR., M.D.

Ilfeld, F. W.: A New Method of Strapping for Back Strain with Sciatica. *New England J. Med.*, 1939, 220: 412.

The author describes a new and simple method of strapping for back strain with sciatica, particularly for cases with contracted fascia lata or pain on internal rotation of the leg in the prone position, which indicates irritation of the pyriformis muscle.

The treatment consists of relief of the tension of the fascia lata tensor, and the gluteus maximus and pyriformis muscles by transference of the strain to the lower back by means of straps of adhesive tape applied to the thigh and back. The patient must be in the correct position. The subject lies on the unaffected side with the back toward the examiner (Fig. 1). The legs are flexed 30 or 40 degrees, with the knees at a right angle, and several pillows are placed between the thighs to bring the upper or affected leg into 20 or 30 degrees of abduction and 20 or 30 degrees of external rotation. Three layers of adhesive tape are then applied. The first layer consists of long strips of 2-in. tape, as shown in the illustration. These are placed beginning 8 cm. above the knee and about 5 cm. from the middle of the

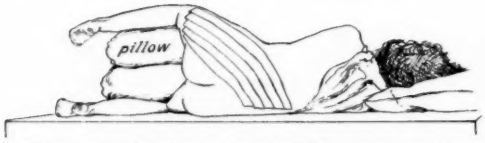

Fig. 1. Longitudinal strips of adhesive tape are placed on the thigh, hip, and back, with the leg in 30 degrees of abduction, 40 degrees of flexion, and 20 degrees of external rotation.

Fig. 2. From below upward, transverse pieces of adhesive tape are fastened over the longitudinal strips covering the thigh, hip, and lower back.

anterior thigh. They are brought upward on the thigh, over the crest of the ilium, 5 cm. posterior to the anterior superior iliac spine, and continued onto the small of the back across the midline, as far superiorly as the twelfth thoracic vertebra. Similar overlapping longitudinal strips are laid on the thigh, crossing the buttock and sacrum onto the lumbar region of the back, until the whole of the lateral thigh is covered. From below upward, transverse pieces of adhesive tape are fastened over the longitudinal strips covering the thigh, hip, and lower back (Fig. 2). A third layer of tape is placed similar to the first longitudinal layer. The leg is thereby strapped in abduction, flexion, and external rotation, which relieves the tension on the muscles involved in these actions, that is, the fascia lata tensor, and the gluteus maximus and the pyriformis muscles.

The treatment is based on the assumption that back pain with sciatica may in some cases be due to localized muscle spasm, which either disturbs the mechanism of the spine or directly irritates the sciatic or gluteal nerves. Good results with prompt relief of pain are reported in the treatment of this type of case.

No emphasis is placed on after-care except the advice that the patient refrain from heavy lifting or heavy work. The tape is removed after from five to seven days. If the patient is symptom free, no other treatment is given except exercises for stretching the fascia lata. F. HAROLD DOWNING, M.D.

Gilmour, J.: The Relationship of Acetabular Deformity to Spontaneous Osteo-Arthritis of the Hip Joint. *Brit. J. Surg.*, 1939, 26: 700.

The onset of spontaneous osteo-arthritis in the hip joint is common when the acetabulum is increased in depth. Osteo-arthritis affected 80 per cent of acetabular protrusions and appears to develop spontaneously in one or both hips at any age and on the slightest provocation. The deeper the socket, the greater is the proclivity toward osteo-arthritic degeneration.

In the normal hip joint there is a protective fluid mechanism which plays an important part in weight transmission and in joint economy. In acetabular deformities there is loss of function and an interference with the operation of the fluid mechanism which is proportional to the increase in acetabular depth. Osteo-arthritic degeneration develops whenever this fluid mechanism is impaired, and is accelerated by trauma, superadded infection, and any remote cause which lowers the vitality of the individual.

The protective fluid mechanism of the hip joint depends upon the sucker-like grip of the cotyloid ring cartilage on the femoral head, upon the capsule of the joint, and on the synovial fluid. Increased acetabular depth modifies each of these factors responsible for the normal fluid protective mechanism. There is a progressive loss of contact between the cotyloid ring and the femoral head as the acetabulum deepens. The progressive failure in function of the cotyloid ring permits frictional contact between articular surfaces. Capsular shortening accompanies increased acetabular depths and fixed flexion deformities commonly follow. These flexion deformities modify the joint mechanism considerably. Reduction in the supply of synovial fluid probably follows atrophy of the intra-articular synovial membrane from pressure as a result of capsular shortening.

Roentgenograms, diagnostic sketches of the roentgenograms showing the distribution of iodized oil in hip joints in flexion and extension, and enumeration of the roentgenographic findings in osteo-arthritic hip joints are presented.

ROBERT P. MONTGOMERY, M.D.

Nicole, R.: Osteochondritis Dissecans of the Hip Joint and Accidents (Osteochondritis dissecans des Hueftgelenkes und Unfall). *Ztschr. f. Unfallmed. u. Berufskrkh.*, 1938, 32: 212.

The author reports 3 of his own cases of osteochondritis dissecans of the hip joint. Since this lesion is always doubtful and also rare, his cases were presented in the form of roentgenological studies. There is no pathognomonic syndrome presenting a characteristic clinical picture for diagnostic purposes. The roentgen plates are the decisive factors.

Osteochondritis dissecans in other joints does not present the same conditions as in the hip joint; in the latter the following peculiarities are notable: the more advanced age of the patient, the marked enlargement of the involved area, the absence of a joint mouse, the greater tendency of the joint to develop arthrosis deformans, the absence of any occupational condition favoring its occurrence, and, finally, the absence of a definite history of a causative accident. The problem of its cause is the same as in Legg-Calvé-Perthes' disease. The author states that even though a previous trauma could not be considered as the cause, we must reckon with

certain mechanical factors which would favor the occurrence of the disease. In addition, special tendencies during the development and the mal-development of the epiphysis and, above all, the time of epiphyseal ossification must be considered. The developmental irregularities of the epiphysis do not lead to a characteristic disease of the bone, but only to an abnormal formation with physicochemical differences in the marginal zone and to dissimilarity in the resiliency of joint action. The result is a local change with a lowered resistance to mechanical and especially to tangentially operating influences. In this respect osteochondritis dissecans, Perthes' disease, and epiphyseal separation of the hip joint are pathogenetically similar processes. According to the developmental stage of the epiphysis either one or the other form of the disease occurs.

These theoretical considerations, however, do not constitute a basis for practical substantiation. An accident is causative in the ordinary fracture. Osteochondritis dissecans and joint mouse *per se* are not affections of a traumatic character. The appearance of these conditions immediately after an injury does not establish the fact that they are the result of the injury; neither would the separation or the mobilization of a joint mouse, which might have occurred sooner or later anyhow, prove to be a consequence of the trauma. On the other hand, the transitory condition of incarceration with simultaneous contusions and distortional injuries following a proved severe accidental traumatism creates a liability. However, if weeks have passed since the accident, liability is more difficult to establish. We do not possess sufficient clinical, roentgenological, and pathologico-anatomical criteria to differentiate between the "osteochondritis dissecans of Koenig" and the hip-joint fracture caused by an accident. Judgment must, then, depend upon proper regard for practical evidence and above all upon the patient's clinical history preceding the accident. In hip-joint osteochondritis this causative sequence is not to be considered as, to date, such a condition has never been reported as following an accident; and liberation of a joint mouse practically never occurs in the hip-joint. Neither is workmen's compensation justifiable, as the regular joint activity, which leads to this pathology, never overtaxes the maximal physiological requirements.

(HEINEMANN-GRUEDER). MATHIAS J. SEIFERT, M.D.

Alpert, L.: Tuberculosis of the Symphysis Pubis. *New England J. Med.*, 1939, 220: 786.

The author reports his experiences with the treatment of 4 cases of tuberculosis of the symphysis pubis in 2 of which the symphysis was splinted indirectly by ankylosis of both sacro-iliac joints.

Previous reported operative methods of treatment of this lesion have been largely directed at the local lesion, such as thorough curettage of the infected bone and drainage of any abscess present, in accordance with the accepted treatment for osteomyelitis. Autogenous bone grafts have also been used, being placed across the symphysis, but in general, bone grafts do not attach themselves favorably in a tuberculous field and accordingly the indirect method of splinting was considered more favorable.

The type of fusion operation is considered of secondary importance. The operation is performed in a clean field and on healthy bone, and any type of fusion, if efficiently performed, will result in ankylosis of the joint. Both the Smith-Petersen and Campbell methods were used. Only one joint was fused at a time.

The author believes that by indirect splinting of the symphysis with sacro-iliac fusion, there is a better chance for the tuberculous process to subside and the pubis to fuse spontaneously. Very favorable results were obtained in the cases reported as compared to other methods of treatment; however the series is too small and the period of observation too short to permit proper evaluation of the method at this time. F. HAROLD DOWNING, M.D.

Jirasek, A.: The Future of Surgery of the Relaxed Knee Joint (L'avenir de la chirurgie du genou mou). *Rev. d'orthop.*, 1939, 26: 97.

In the surgical treatment of the relaxed knee, Jirasek notes that the meniscus plays the primary rôle. He has found that the meniscus in such knees may be abnormally mobile, and the condition resembles very closely that observed when the meniscus is torn or dislocated. If the meniscus is injured, it should be removed in its entirety. However, the author is convinced that pathological conditions in the meniscus are not the only factors in the alteration of tone and function of the knee joint. Absence of the intra-articular fatty tissue; and pathological changes in this tissue, such as hypertrophy, sclerosis, or necrosis, may also be a factor and should not be overlooked in operations on the joint. Absence of the periarticular fat interferes with the mechanical balance and nutrition of the synovial membrane, and causes it to be drawn into the interior of the joint with certain movements of the limb. Periarticular inflammation of the joint may occur after certain injuries; the author has had good results in the treatment of this condition with local infiltrations of novocaine.

Another factor of importance in injuries of the knee joint is the condition of the synovial membrane; either its power of secretion or its power of absorption may be diminished; there may be a diminution in the amount of synovial fluid, sometimes entire absence of fluid (dry knee); or an increase in the amount of fluid (hydrarthrosis). Thus it is evident that in the treatment of the relaxed knee, not only the mechanical conditions of the injured meniscus, but also the functions of the synovial membrane and the fatty tissue must be considered. The future of the surgical treatment of injuries to the knee joint depends upon a more careful study of these factors, and upon a development of more effective therapeutic measures if the aforementioned functions fail. ALICE M. MEYERS.

FRACTURES AND DISLOCATIONS

Pervès and Badelon: Results of the Surgical Treatment of Recurrent Dislocations of the Shoulder (Résultats du traitement chirurgical des luxations récidivantes de l'épaule). *Mém. l'Acad. de chir.*, Par., 1939, 65: 349.

In 1924 Oudard described the technique which he used in the treatment of recurrent dislocation of the shoulder since 1921 at the Hospital of Sainte-Anne at Toulon. The principal points of the technique consisted in reinforcement of the anterior portion of the capsule by shortening the subscapular muscle and in the creation of an elongated coracoid apophysis. The latter was at first produced by division of the coracoid with a Gigli saw at the junction of its vertical and horizontal part and introduction of a tibial graft between the two fragments. Later Oudard found it simpler to divide the horizontal portion of the coracoid process into internal and external parts, permitting the former, detached at its base, to glide over the external fragment. Fusion was obtained by leaving the two fragments in contact for about 1 cm. In this way an elongation of from 2.5 to 3 cm. was obtained, which sufficed in most cases. This technique has since been adopted by nearly all French surgeons.

Many surgeons felt, however, that the coracoid intervention would suffice *per se* without shortening of the subscapular muscle, and several modifications of the Oudard method appeared. Others regarded the shortening of the subscapular muscle as the most important feature of the operation and used it without the coracoid procedure. At present the simplified Oudard operation may consist either in elongation by means of a graft or in elongation by means of plastic operation on the bone.

In an attempt to evaluate the comparative merits of these two methods, the writers review the statistics of results which have been obtained by various surgeons.

From 1923 to 1937 about 31 patients were treated at the Sainte-Anne Hospital of Toulon. Of these, 23 reported for re-examination or replied to questionnaires. It is probable that there was no recurrence in the 8 patients who failed to reply. Of the 23 patients, 10 were operated upon by the original Oudard technique with 1 recurrence after five years. Eight patients were treated by elongation only, accomplished by division of the coracoid. There was 1 recurrence after seven months. Five patients were operated upon by the Wilmoth-Tarnier method (insertion of a graft into the fenestrated coracoid and coracobrachialis). There was 1 recurrence after one year. Judgment of the value of an operation requires that several years should have elapsed. The percentage of recurrences serves as a criterion only if based on a large series of cases. Other recurrences after operation included 2 cases mentioned by Oudard, and 4 cases reported in the literature, all having been treated by the Wilmoth-Tarnier method. No conclusions can be drawn as regards the advantages or disadvantages of the latter until a larger series has been reported. However, from the results studied it would appear that such grafts may be resorbed completely or diminish so markedly that the desired continuity with the coracoid is not attained.

The causes of recurrence are complex and frequently obscure. Wilmoth reported 1 case treated by simple elongation of the coracoid by a graft. There was no recurrence for nine years. Tavernier reported a similar case without recurrence for two years. Lenormant described 2 cases treated by the complete Oudard operation without recurrence for two years and eleven months and seven months, respectively. He did 5 elongations of the coracoid with graft, without recurrence in 4 for one year and eight months, two years and four months, seven months, and four months, respectively. There was a recurrence after four months in 1 case in which a second operation revealed a pseudarthrosis of the graft. A new graft was inserted and there was no further recurrence for two years and ten months. Jullien mentions a case of Menegaux with elongation of the coracoid by graft and no recurrence for one year. Bazy reported 12 cases treated by elongation with graft. He was greatly pleased with the results and gave detailed results in 3 cases, 1 having remained without recurrence for six years, 1 for two years and seven months, and the third for eighteen months in spite of the patient's having suffered a violent injury. Avril reports 5 cases without recurrence but none was observed for a year. Gossard described a case treated by the complete Oudard operation without recurrence for two years; Gernez' patient had no recurrence for six years. Bloch describes 3 cases treated by simple elongation and graft with 1 recurrence. In this case a second operation revealed that the graft had been largely resorbed. The duration of cure for the 2 other cases was not given. Desplas reports 6 cases but without end-results.

Of 9 cases reported by Cuneo 4 remained without recurrence for nine and one-half, nine, five and one-half, and five and one-half years, respectively. There were 2 recurrences, one after an interval of eight years, the other after an interval of one and one-half years. In 3 of the cured cases the osteoplastic elongation was used and in 1 the clavicular graft. In the 2 cases of recurrence osteoplastic elongation was used in one and the clavicular graft in the other. Gouverneur did the complete operation in 2 cases without recurrence for eight and two years, respectively, and simple elongation in 1 case with no recurrence for five years. Decker observed no recurrences after three years in 6 patients operated upon by him by shortening of the subscapular tendon and osteoplastic elongation of the coracoid.

The present writers describe 5 personal cases treated by elongation of the coracoid with graft with 2 recurrences, one following violent injury and the other following a simple strain. In one of these cases the graft was resorbed and in the other there appeared to be a fracture between the graft and coracoid.

Thus recurrences seem more frequent following simple elongation of the coracoid with graft.

The authors recommend the complete Oudard operation as giving the best results.

EDITH SCHANCHE MOORE.

Hunt, G. H.: Fracture of the Shaft of the Ulna. *J. Am. M. Ass.*, 1939, 112: 1241.

Fracture of the shaft of the ulna with dislocation of the head of the radius is described as a fracture-dislocation which occurs much more frequently than is ordinarily recognized. The fracture of the shaft of the ulna is readily recognized but the dislocation of the head of the radius is not recognized primarily because many roentgenograms do not take in the elbow joint in both views. When the fracture of the shaft of the ulna alone is recognized and treated, the percentage of permanent disability is quite high. In any indirect violence, the author believes that it would be very difficult to put enough stress on either the radius or ulna to fracture it without having some type of lesion of the other bone. It is imperative therefore that when one bone is fractured, this type of dislocation of the head of the radius should be especially looked for. For all practical purposes, injury to the ulna by indirect violence means injury to the radius also.

Roentgenograms in two planes are required. If the radial diaphysis points towards the capitellum in both views, well and good; if in either one of them it is pointing somewhere else than directly at the capitellum, the epiphysis of the radial head is either dislocated or separated.

After the diagnosis has been made, the author suggests that the best orthopedic or fracture specialist available may well be consulted at the beginning rather than after several weeks of unavailing treatment. The difficulty in this type of fracture lies first in the closed reduction of the dislocated radial head into place between the torn ends of the ruptured annular ligament, and second in that when the radius is reduced to its normal length it is quite a difficult feat to get the ends of the ulna into apposition so that healing will result. The reduction of the dislocated radial head is often impossible without an open operation. If operation becomes necessary the radial head should be replaced in its normal position between the torn ends of the annular ligament and sutured.

It is better to have ulnar non-union with the radius restored to normal than to leave the patient with a dislocated radial head. If operation to replace the radial head becomes necessary, the internal fixation of the ulna may be advisable. Late operation in neglected cases must be adjusted to the conditions present, such as resection of the radial head and bone grafting of the ununited ulna.

Three cases of fracture of the ulna and dislocation of the radial head are presented. In the first 2 cases, a satisfactory reduction of the dislocated radial head and satisfactory reduction and union of the fractured ulna were obtained. In the third case, the fracture-dislocation was treated unsuccessfully for two and one-half months and then an open reduction of the dislocated radius and a bone graft of the ununited ulna were performed with apparently good results.

RICHARD J. BENNETT, JR., M.D.

Wenzl, O.: Vertebral Luxation (Ueber Wirbelluxationen). *Beitr. z. klin. Chir.*, 1937, 166: 53.

In dislocations of the vertebral column one must differentiate between luxation alone and luxation with fracture. The diagnosis of a dislocation-fracture is often difficult even with the aid of stereoscopic roentgenograms, and yet from a large clinical experience in this work it is difficult to determine neurologically whether the fracture or the dislocation is responsible for symptoms and signs. The author describes the mechanism of luxations through which injury to the spinal cord occurs. Changes are described ranging from the simplest block to the most severe laceration. It is noted in the true luxation that there seldom are medullary symptoms. However, if the pressure of the luxated vertebræ on the medullary substance is not removed its blood and lymph supply will be very quickly and permanently injured. A removal of the posterior lamina of the vertebral canal may or may not help. If help is to be obtained it must be quickly or there will be permanent changes in the spinal cord. By waiting, this pressure damage will be markedly increased. Simple laminectomy as well as extension of the spine will aid even though laminectomy is a more dangerous procedure.

The question arises whether the dislocated vertebræ should be reduced by means of closed or open reduction. The bloodless or closed procedure has had its greatest use in the cervical portion of the vertebral column; however, if the dislocation has occurred further down and success is so uncertain or the luxation so extensive that there is danger of secondary harm to the medulla, then the safest way is open reduction; the medulla will be released from the effect of pressure; tension is liberated, and the circulation of the spinal fluid and of the blood and lymph streams to the medulla is re-established.

The results of the various methods were given. The end-results of conservatively handled cases approached those of fracture alone. The results of laminectomy were not superior to those obtained from conservative treatment. The open procedure was very rarely used and then only in those cases which were poor risks from the beginning. In these the best results were obtained, but such results would scarcely have been attained through conservative handling. The results of the closed and open reductions are therefore dependent upon the time of operation as well as the time which has elapsed since the injury. The time factor is especially significant in closed reductions. Even though closed reduction gives some degree of satisfactory results, one must still consider cases in which open reduction is indicated. The operation is described:

After the vertebral arch is exposed and the muscles of the back retracted, the articular processes are exposed, as well as the spinous processes and posterior arches of the remaining intact vertebræ. Then palpation is done along the posterior dural surface in the curve of the dislocated vertebræ, the arch is grasped with two bone hooks, and further reduction is governed by the intact vertebral arches. The successful reduction of the vertebræ without difficulty and without resection of the articular processes is carried out by extension of the vertebral column. In this manner the elevators can be applied to the articular processes and good results will be obtained. The tissue superimposed on the dura (periosteum and musculature) and hematoma are withdrawn from the arc space. The vertebra is reduced and the articular processes proceed to function and carry the weight of the vertebral column again as previously. There is no possibility of a recurrent dislocation of the vertebræ as long as the vertebral column is maintained in the position of extension.

In such cases there is the possibility of a disastrous result to the medulla during interventions. The attempt at reduction depends upon the rapidity of the disappearance of shock in each case. Unfortunately there are usually other injuries to the patient which must be considered before contemplating reduction.

As soon as early open reduction has become generally accepted, it will be attempted in a series of cases; the vertebral dislocation will have lost much of its terror and the prognosis will improve. It will then be considered a simple vertebral operation according to the experience of the individual authors. In dislocation of the atlas the author is in favor of the closed reduction, especially when life is in danger but the anatomical relation can still be obtained. Wire may be used for fixation of the cervical vertebræ to obtain bony healing of the fracture of the dens epistrophei. Dislocation-fracture may be treated in a similar manner though successful results were very few. There is a difference of opinion regarding the open reduction of vertebral dislocation and fracture-dislocation.

(Bode). Richard J. Bennett, Jr., M.D.

McFarland, B.: Congenital Dislocation of the Hip. *Brit. J. Surg.*, 1939, 26: 791.

Prolonged Thomas-splint skin traction has been successfully used by the author in 18 cases of dislocation of the hip of congenital origin in preparation for a shelf operation in patients from ten to sixteen years of age, as a substitute for manipulative reduction under general anesthesia in younger patients and in cases with pathological dislocation of the hip.

Closed manipulative reduction is seldom possible after the age of ten years and a stiff hip is a common result following open reduction because of pressure of the femoral head against the acetabulum by force of the previously shortened soft tissues. In many cases the acetabulum is inadequate and the absence of an adequate buttress against which to lodge the head of the femur makes retention of the reduced femoral head uncertain.

When the head of the femur has been pulled down to below the level of the true acetabulum by skin traction from two to eleven months, a shelf is usually made by turning down a large plaque of bone from the false acetabulum, the point of leverage being the upper rim of the true acetabulum. The shelf is fixed in position by wedges of bone cut from the ilium. During the operation the leg is held in an extended position to facilitate the operative procedure. Traction may be maintained during the operation and is used for about six weeks following the operation. A plaster cast is then applied and worn for two months. Walking is started prior to or following the removal of the cast.

Photographs of a patient, roentgenograms, and schematic drawings of the technique for the shelf operation and of the author's traction apparatus are presented. The apparatus combines the advantages of the fixed type of traction and the continuous weight traction. A ratchet is used so that any length gained by traction is held as a fixed lengthening.

Robert P. Montgomery, M.D.

Crego, C. H., Jr.: The Use of Skeletal Traction as a Preliminary Procedure in the Treatment of Early Congenital Dislocation of the Hip. *J. Bone & Joint Surg.*, 1939, 21: 353.

Prior to 1933, the author has found no reference in the literature relative to the use of skeletal traction as a preliminary procedure to either open or closed reduction, in the treatment of children under seven years of age with congenital dislocation of the hip. He finds that this procedure is less radical than the old classic one of forcible stretching and massaging of those structures which hinder manipulative reduction, and states that if the mechanical obstacles can be gradually and effectively stretched and relaxed by preliminary skeletal traction, the actual placement of the head of the femur into the acetabulum can be accomplished with no trauma whatever and the postreductive intra-articular pressure can be eliminated. Especially in children, open operations are severe tests of their endurance, and a preliminary procedure which alleviates the necessity both of radical cutting of the soft parts and the forcible use of the hip skid should be a distinct advantage from all angles. Preliminary traction also has the advantage of elimination of the postreductive intra-articular pressure of the head against the acetabulum during the immobilization period, and, when acetabular reconstruction and shelving operations are done, preliminary skeletal traction avoids the tendency toward poor displacement so frequently seen when the head has not been adequately pulled down opposite the center of the acetabulum.

Crego uses a wire traction, but has designed his own traction bow in 4 different sizes. The technique of inserting wire, and applying traction is cited in detail. Well-leg counter-traction has been used but

has been found to be less satisfactory than simple elevation of the body, especially in very young children. In children under four years of age, the initial weight used is about 10 lb. and additional weight is added according to the individual requirements of each patient. The descent of the head should not be too rapid. Weight is added or subtracted, so that the head will be completely pulled down in about ten days or two weeks. The level of the trochanter should be checked roentgenographically. The amount of traction is reduced, so that there will be just enough pull to provide displacement of the head, and the traction should be continued at least ten days or two weeks after roentgenographic examination shows the head to be well down opposite the lower half of the acetabulum. In those cases in which it is certain that the acetabulum is too shallow or its roof too vertical to hope for permanent reduction, and in those cases in which closed reduction cannot be effected without an anesthetic, open operation is indicated. In several instances, traction was applied with a wire through the tibia, but this was not satisfactory.

Crego has used this method of skeletal traction as a preliminary procedure to either open or closed reduction in 27 children under the age of seven years with posterior congenital dislocation of the hip. In 11 cases the deformity was bilateral, which made a total of 38 hips which were treated. There have been 29 closed reductions without anesthesia and 9 open reductions, whereas previous to the use of skeletal traction, 80 per cent of the writer's cases in children under seven years of age were treated by open operation. The acetabulum was reconstructed in 15 instances, purposely not reconstructed in 4 instances, and should have been reconstructed in 3 additional cases.

EMIL C. ROBITSHEK, M.D.

De Moraes, F.: Isolated Fractures of the Greater Trochanter (Les fractures isolées du grand trochanter). *Rev. d'orthop.*, 1939, 26: 223.

While isolated fractures of the greater trochanter are considered to be of rare occurrence, Moraes is of the opinion that such fractures would be found more frequently if radiographic examination were made in every case of contusion of the hip.

Three cases are reported occurring in men aged twenty-three, forty-two, and sixty-three years, respectively. In 2 of these cases, the patient had tried to catch himself when slipping on a slippery walk, and had made a violent and unco-ordinated movement of the muscles attached to the greater trochanter. In the third case (that of the oldest patient) there had also been a sudden but less violent movement before the symptoms developed. In 2 cases the patient was unable to walk and in 1 case he walked with a marked limp. On admission to the hospital the extremity was in slight flexion, abduction, and external rotation; any attempt to place it in the position of adduction and internal rotation caused pain. In 1 case, admitted twenty-four hours after the injury, there was ecchymosis and edema in the region of the trochanter. These symptoms are characteristic of fracture of the greater trochanter, but radiographic examination should be made to confirm the diagnosis.

In the treatment of these fractures without displacement or with very slight displacement, immobilization of the extremity in complete abduction and external rotation for six weeks gives good results. This was the method used in 2 of the cases reported. In the third case the displacement of the fragment was such that operation was advised but refused. As there is often an associated osteoporosis in such cases, wiring of the fragment (cerclage) is the best method of fixation.

ALICE M. MEYERS.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Uggeri, C.: Tuberculous Phlebitis (Sulla flebite tubercolare). *Clin. chir.*, 1939, 15: 283.

Uggeri distinguishes between tuberculous phlebitis, in which histological examination demonstrates the specific nature of the disorder, and phlebitis in tuberculous subjects, in which its specific nature, although probable, cannot be demonstrated with certainty.

Tuberculous phlebitis is divided into periphlebitis and endophlebitis. Periphlebitis is due to propagation of the infection from a focus adjacent to the vein and attacks preferably the small veins; these are easily thrombosed, while the large veins may show proliferation of the intima without thrombosis. Endophlebitis is due to localization of the tubercle bacillus in the intima and may present various anatomopathological aspects. In the large veins, the most common form is the polyp, which floats in the blood stream and may attain considerable length. The center of the polyp is composed of typical tuberculous granulation tissue, partly caseated; its periphery is covered by a layer of connective tissue originating from the intima. Tubercle bacilli may be demonstrated in the tissue. In the smaller veins, the most common aspect is that of obliterating thrombo-endophlebitis. The process is identical with that causing the polypous form, but the narrowness of the vein leads to occlusion. Endophlebitis occurs decidedly more often than periphlebitis and attacks, in the order of frequency, the pulmonary, suprarenal, dura mater, renal, and splenic veins. Isolated cases in other veins have been reported. From the clinical point of view, the tendency toward localization of the process in the visceral veins obscures the symptoms, which may even be absent in many cases; it is interesting in that it may give rise to generalized miliary tuberculosis, especially from the pulmonary veins.

Phlebitis in tuberculous subjects has been divided into four clinical forms:

1. Late phlebitis in patients with cavities. Its most frequent localization is in the superficial or deep veins of the lower extremities and its symptoms are fever, pain, the presence of a hard, painful cord corresponding to the course of the vein, edema, and functional disability; a superficial collateral circulation may develop.

2. Early phlebitis. This is rare, may appear in various types of tuberculous subjects, including the apparently healthy and initial cases, and occurs usually in the superficial veins of the lower extremities, for the most part unilaterally and generally insidiously. It begins with paresthetic sensations, which are gradually replaced by localized pain. This pain disappears completely within two weeks. Localized, white, slightly tense edema, which does not pit, sets in a few days after the appearance of pain, and is resorbed by rest in bed in from fifteen to twenty days. Functional disability is very slight and a collateral circulation usually does not develop. Its differential diagnosis includes chlorotic, rheumatic, gouty, syphilitic, gonorrheal, typhoid, and subacute septicemic (Vaquez) phlebitis.

3. Superficial phlebitis of the upper extremities. This is rare and may involve successively various segments of the veins on either side. Its symptoms are slight and fleeting; there is slight localized pain, especially during movements, limited edema, and redness along the course of the involved vessel. It must be differentiated from syphilitic phlebitis. Its local prognosis is good, but its general prognosis unfavorable.

4. Phlebosclerosis. This is frequently found in tuberculous cachexia and may be uniformly distributed over the vein or under the form of plaques; palpation reveals a hard, mobile, painless cord.

All authors agree that the tuberculous origin of phlebitis can be considered as certain only when positive results have been obtained by inoculation of the guinea pig with blood; but that it may be considered as probable in the other cases. As to its pathogenesis, they do not feel justified in deciding between the endophlebitic and the periphlebitic origin, but they incline toward the latter.

Uggeri describes and discusses 2 personal cases: 1 of early phlebitis in an apparently healthy subject, and 1 case of phlebitis that occurred during the last stages of tuberculosis. The ultimate course of the 2 cases confirms the unfavorable prognosis attributed to this complication. He believes that these cases of phlebitis are not caused by ordinary bacteria, but by the tubercle bacillus. Therefore, he recommends the classification of tuberculous phlebitis with or without specific granuloma; the latter, no matter in what stage of tuberculosis it may occur, would invariably reflect a condition of peculiar deficiency of the organic defense powers against the specific infection. RICHARD KEMEL, M.D.

Ochsner, A., and DeBakey, M.: The Treatment of Thrombophlebitis by Novocaine Block of the Sympathetics. *Surgery*, 1939, 5: 491.

Because of recent experimental and clinical investigations, the authors are in hearty agreement with the contention of Leriche that the clinical manifestations in thrombophlebitis are due largely to the vasomotor reflex which originates in the thrombosed segment, that the symptoms can be relieved completely, and that the convalescence will be materially shortened by blocking the sympathetics and thus breaking the reflex.

The authors have used novocaine block of the regional sympathetic ganglia in a number of cases and have obtained uniformly successful results.

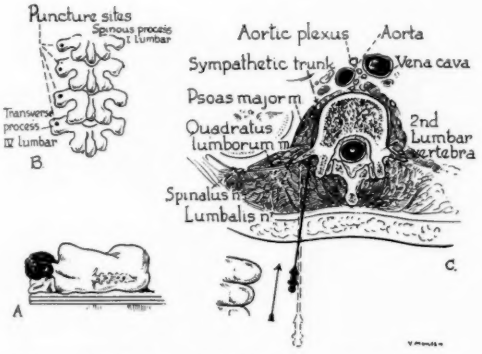

Fig. 1. Technique of lumbar sympathetic block in thrombophlebitis of lower extremities. *A*, Lateral recumbent position of patient. *B*, Cutaneous sites of puncture lie on a horizontal level with and two and one-half finger-breadths lateral to upper part of spinal processes of first four lumbar vertebræ. These puncture sites in the skin are immediately over the transverse processes of the respective vertebræ. *C*, Each needle is inserted vertically until transverse process of corresponding vertebra is reached as represented by dotted needle. Direction of needle is then changed slightly and inserted two and one-half finger-breadths beyond the transverse process so that its point lies near the anterolateral surface of the body of the vertebra where the sympathetic chain lies.

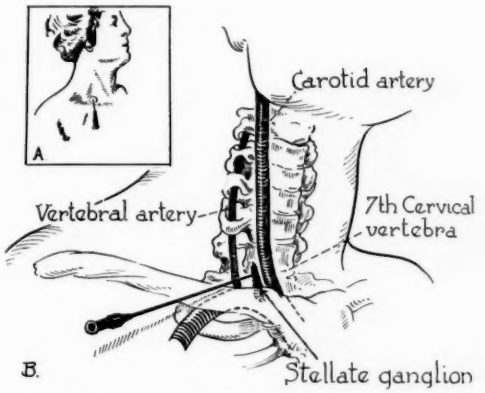

Fig. 2. Technique of stellate-ganglion block by anterior approach. *A*, Cutaneous site of puncture is 1 cm. medial to the midpoint of the clavicle and immediately over its upper border. *B*, Needle is introduced on a horizontal level with the upper border of clavicle and directed posteriorly and medially at a 45 degree angle with the midline. The point of the needle impinges against anterolateral surface of the body of the seventh cervical vertebra or at the junction between the seventh cervical and first thoracic vertebræ.

Immediately following the injection there has been complete relief of pain, which in some instances has been permanent. In other cases subsequent injections have been required, but only rarely has it been necessary to use more than three injections. The temperature declines within twenty-four hours and generally is normal within from seventy-two to ninety-six hours. The associated swelling of the extremity begins to diminish within the first twenty-four to forty-eight hours, and usually within a week to ten days has disappeared completely. In more than one-half the cases the extremity has returned to its normal size within four days after the beginning of the treatment. All of the patients in this group were well within two weeks, and all walked out of the hospital within, or shortly after, that period of time. Equally as good results can be obtained in the upper extremity as in the lower.

The technique of the injection of the lumbar sympathetic ganglia, as employed by the authors, is extremely simple and may be performed with the patient in bed. The patient is placed in the lateral recumbent position with the affected side up (Fig. 1 A). Wheals are made in the skin by intracutaneous injections of 1 per cent novocaine at points approximately from 2 to 2½ finger breadths lateral to the upper part of the spinal processes of the first, second, third, and fourth lumbar vertebræ (Fig. 1 B). These points of the skin lie immediately over the transverse processes of the corresponding vertebræ. A 20 or 22-gauge needle, 8 to 10 cm. in length, is inserted vertically through each wheal until the transverse process of the corresponding vertebra is reached, usually a distance of about 4 or 5 cm. The direction of the needle is then changed slightly, either superiorly or inferiorly, so that it can project beyond the process, and is pointed slightly toward the midline. The needle is then inserted another 2½ finger breadths so that its point impinges against the anterolateral surface of the body of the vertebra in the retroperitoneal space (Fig. 1 C). Through each of the needles, 5 c.cm. of 1 per cent novocaine are injected. Before injection, aspiration should be done in order to avoid the injection of novocaine into a blood vessel.

The authors have had 2 cases of thrombophlebitis involving the upper extremity, in which this method of therapy was used. The technique of injection of the cervical dorsal ganglia is extremely simple and either the posterior or the anterior approaches may be employed. Both approaches are described but the authors prefer the latter, the technique of which is a modification of that described by Leriche. This consists of the production of an intracutaneous wheal of novocaine at a point 1 cm. medial to the midpoint of the clavicle and immediately over its upper border (Fig. 2 A). A fine lumbar puncture needle is introduced on a horizontal level with the clavicle and directed posteriorly and medially at a 45° angle with the midline (Figs. 2 B and 3). The point of the needle, after being introduced for a distance of from 6 to 7 cm., impinges against the anterolateral surface of the body of the seventh cervical vertebra, or at the junction between the

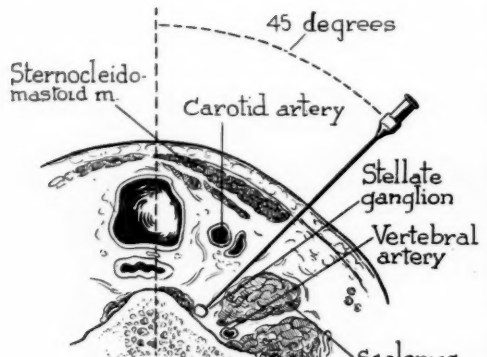

Fig. 3. Diagrammatic drawing illustrating introduction of needle posteriorly and medially at a 45 degree angle with the midline so that the point of the needle impinges against anterolateral surface of the body of the seventh cervical vertebra or at the junction between the seventh cervical and first thoracic vertebrae where stellate ganglion lies.

seventh cervical and first thoracic vertebræ where the stellate ganglion lies. After it is ascertained by aspiration that the needle is not in the vessel, 10 c.cm. of 1 per cent novocaine are introduced.

Groth, K. E.: Several Cases of Recurrent Arterial Emboli in the Extremities (Einige Faelle von rezidivierender Arterienembolie in den Extremitaeten). *Arch. f. klin. Chir.*, 1939, 194: 413.

Groth discusses 3 Swedish and 3 reported cases of recurrent embolism in the same limbs. As the result of conscientiously examined Swedish statistics, the author believes that such occurrences amount to about 4 per cent.

His own case was remarkable in that the first emboli occurred almost simultaneously in 3 limbs, viz., in both legs and in the right arm of the patient. By means of direct arteriotomy at the sites of the blockings (left popliteal artery, right common femoral artery, and right brachial artery), as well as by massage of the exposed arteries, the emboli could be excised, and the circulation immediately and wellnigh perfectly re-established. Postoperatively, there was no special difference in the arm; but the right leg showed sharply extended toes and only a little movement in the ankle with hard, ischemic musculature. The left leg slowly developed a dry gangrene in parts, and it was amputated by the Gritti method. The laboratory examination revealed a normally healed arteriotomy wound; the posterior tibial artery was filled with thrombotic masses; the anterior tibial artery was patent.

About five months after the first embolism the patient was afflicted with a second attack. He then had a sensation of both arms' dying without pain and without their feeling cold. This lasted a few minutes, then was followed by most violent pains in the upper abdomen, defecation, and frequent non-bloody vomiting. The upper abdominal symptoms diminished in one and one-half hours, but then a feeling of coldness and pains in the right leg and foot occurred. At the site of the former arteriotomy a vascular blocking 3 cm. in length was found; the efferent vessel was pulseless. The embolus was removed through a little deeper incision at this time. The abdominal pains vanished at once. However, before the incision in the vessel-wall was closed, a new blocking of the artery directly at the wound occurred. This clot was removed and after suture of the vessel the circulation was completely restored. The abnormally sharp extension of the toes was corrected a month later by tenoplasty. This was followed ten days later by an apparently fatal brain embolus, which, however, was also dislodged. The warning is justified that such patients should not be subjected to operations unless absolutely indicated.

From the clinical findings and the time element of occurrence and recurrence, the assumption is justifiable that a large embolus was discharged from the heart, caused a short obstruction to the circulation in the arms, then lodged in a branch of the aorta leading to an abdominal artery in which it remained fixed. Later a dislodged segment of this embolus was carried to the typical location of the femoral artery, from where it could travel no further. The sudden release of the circulation following embolectomy then liberated the rest of the embolus, which was carried to the arteriotomy sites. The preoperative treatment of this patient consisted in the administration of eupavarin and acetylcholin, both of which were ineffective. This failure, doubtlessly, was due to the fact that the expected arterial spasms were either too mild, or entirely absent.

The other cases were reported in detail also. All of the patients were between forty-four and sixty-two years of age. Four of the six were men. The vessels involved were the popliteal and brachial arteries, the bifurcation of the aorta, and the axillary and femoral arteries. The clinical symptoms often were characterized by a marked constitutional letdown shortly after the embolism occurred. The local symptoms are definitely known. The embolus always was found to be quite a distance proximal from the upper border of the skin discoloration. In all the recurrences the disease was acute, and the clinical picture quite generally simulated the first appearance of the embolism with exception of the pain, which was markedly less or entirely absent.

The treatment consisted of a simple arteriotomy with definite avoidance of the introduction of any special instruments into the blood vessels. The most favorable results of arteriotomy were obtained during the first ten hours; in 2 cases, however, the time was eleven and twelve hours, respectively. All secondary operations of the embolisms were done in the ten-hour limit, often even earlier. The immediate local results of secondary arteriotomies and their final outcome corresponded with the favorable outcome of the first operations taken collectively.

The results of treatment in the recurrences were good in 5 cases and bad in 1 (gangrene of the arm). Regarding the significance of the collateral circulation in sustaining the affected parts, the author's opinion, supported by case reports in the literature, is that in a number of embolectomies the success was undoubtedly due to the fact that the collateral circulation took up the course of the blood rather than that the blood followed its usual course through the affected vessels. The collateral circulation in the reported cases, however, was of no service to the affected limbs. The suspected influences of the sympathetic nervous system require more substantiating proofs. (Druegg). Mathias J. Seifert, M.D.

BLOOD; TRANSFUSION

Waddell, W. W., Jr., and Guerry, D., III.: Vitamin K and the Clotting Time: with Special Reference to Unnatural Bleeding of the Newly Born. *J. Am. M. Ass.*, 1939, 112: 2259.

The desirability of finding some agent which might materially lessen the incidence of cerebral accidents and unnatural bleeding in the neonatal period prompted this study of the effect of Vitamin-K concentrate on the prothrombin-clotting time and the clotting of the blood of the newly born. The authors review the literature in regard to the use of Vitamin K. It has been found to be an anti-hemorrhagic factor. They then give the results of using Vitamin K on 10 newly born infants, and of the study at the same time of 10 other newly born infants who did not receive Vitamin K. They give charts showing the blood clotting time of those infants who have not had Vitamin K and how the blood clotting time is decreased in those infants who have received Vitamin K concentrate. It is the authors' hope that their studies may materially aid in the decrease of intracranial hemorrhage in the newly born.

Paul Merrell, M.D.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Devenish, E. A., and Miles, A. A.: The Control of Staphylococcus Aureus in an Operating Theater. *Lancet*, 1939, 236: 1088.

A high incidence of suppuration due to staphylococcus aureus in "clean" operation wounds was found to be due to the leakage of staphylococcus aureus through the glove punctures from the skin of a surgeon who proved to be a skin carrier.

The staphylococcus aureus present in the air of the theater and on the skin of the patients operated upon apparently played no part in the incidence of suppuration.

Nasal carriers of staphylococcus aureus among the theater staff do not constitute a danger, provided that masks are made impermeable to direct droplet discharge from the nose and mouth.

All of the strains of staphylococcus aureus recorded fermented mannitol and produced a coagulase for human plasma.

Skin carriers, negative by ordinary swabbing tests, may sometimes be detected by cultivation of the sweat from the inside of rubber gloves at the end of the operation. This method has the advantage of excluding positive results which are due to temporary superficial contamination of the skin.

The frequency of glove puncture during operation was found to be as high as 24 per cent; this was reduced to 14 per cent by precautions to avoid puncture.

The following measures were followed by disappearance of the sepsis: (a) the introduction of cellophane sheets into butter muslin masks; (b) the wearing of batiste sleeves over linen gowns to prevent the escape of skin cocci in sweat; (c) the avoidance of glove puncture during operation by special attention to operative technique; and (d) the avoidance, as far as possible, of direct handling of the tissues.

SAMUEL KAHN, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Blackfield, H. M., and Goldman, L.: Burns in Children. *J. Am. M. Ass.*, 1939, 112: 2235.

In a study of burns in children, the authors found that there were three phases. The burns were treated accordingly.

Primary phase (*traumatic shock*). The identical clinical picture of traumatic or surgical shock with loss of body heat, cold moist skin, rapid pulse, and fall in the blood pressure is presented. This phase is usually transient, but may be prolonged and fatal.

Secondary phase (*concentration of blood*). The hemoglobin content may be elevated as high as 209 per cent. A sustained hemoglobin content of 140 per cent is fatal because it so interferes with the functioning of the blood that it would produce failure of the circulation, the inefficient carrying of oxygen with consequent oxygen starvation of the tissues, a fall of temperature, and, finally, suspension of vital activities. With this change there is an elevation of the non-protein-nitrogen level of the blood and a lowering of the blood chlorides. In the authors' series, the recognition and treatment of this condition has helped to lower the early mortality, although considerable doubt still exists as to why some patients who have been competently treated die in the first seventy-two to ninety-six hours.

Tertiary phase (*toxemia*). Two hypotheses are considered in the cause of this phase of burns; i.e., the theory of broken-down protein with absorption, as promulgated by Davidson, and the theory of infection, held by Underhill and Aldrich. The authors accept both theories in their therapy of this phase.

In the treatment of burns, shock is always treated first and, if necessary, blood transfusion is given. Patients are then placed in the tannic-acid bath of Wells (at from 90 to 100°F.) for from sixty to ninety minutes, with the removal of blebs and necrotic tissue. After drying, a sponge of gauze, soaked in 10 per cent silver nitrate, is applied to the burned areas by blotting. Immediate tanning is produced. A large cradle is then placed over the child and a temperature of from 85 to 90°F. is maintained.

After the first few days the entire burned area is painted several times a day with a 1 per cent aqueous solution of gentian violet.

To prevent dehydration and blood concentration, fluids are forced by mouth, or parenterally. Transfusions are given in the cases of patients with extensive burns. As the eschar loosens it is trimmed away, and gentian violet is applied. For those needing skin grafts, preparation is accomplished by means of tub baths, saline compresses, and the use of diluted azochloramide. Whenever possible, the authors use the intermediate graft of Blair and Brown.

JOHN J. MALONEY, M.D.

Belt, T. H.: Liver Necrosis Following Burns, Simulating the Lesions of Yellow Fever. *J. Path. & Bacteriol.*, 1939, 48: 493.

In the cases of 4 patients who died soon after suffering extensive burns, it was found at autopsy that there were evidences of a severe toxemia. Especially noteworthy were the changes in the liver. The weight varied from 1,360 to 1,720 gm. The parenchyma was pale and of a yellowish or ochre tint, which resembled the boxwood color said to be characteristic of the liver in yellow fever. Histologically, there was widespread necrosis which produced a marked disorganization of the paren-

chyma. The liver cords were jumbled and the sinusoids distorted, but the lobular markings remained distinct because, as a rule, the cells around the portal areas and the central veins were well preserved; i.e., the necrosis was mid-zonal. It consisted of hyalinization and fragmentation of the liver cells. It was not a liquefactive necrosis, nor was it accompanied by more than slight polymorphonuclear reaction. It involved the cells somewhat unevenly, sparing some altogether, and affecting others only in part. There was an associated fatty change of moderate degree which gave the cytoplasm a rather moth-eaten appearance.

Councilman bodies were much in evidence. These are somewhat like Negri bodies, but larger. They appear as rounded condensations of cytoplasm, and range from about 10 to 25 millimicrons in diameter in stained sections. They are hyalinized, deeply eosinophilic, vacuolated, and surrounded by a clear zone. The larger of them sometimes contain pycnotic nuclear remnants and appear to represent whole cells, but the smaller bodies frequently lie within cells, like cytoplasmic inclusion bodies.

Nuclear inclusion bodies of the type described as Class A by Cowdry (1934) were a prominent feature in all 4 livers. They correspond closely with yellow fever inclusions from which they are morphologically indistinguishable.

On the basis of the present study, it appears that toxemia in certain cases of burns produces an effect upon the liver which is similar to that observed in certain virus diseases, and suggests that the noxious agent in both instances may be of a similar character. The present findings are indistinguishable from those occurring in yellow fever.

MANUEL E. LICHTENSTEIN, M.D.

ANESTHESIA

Christophe, L.: Clinical Experience with Different Anesthetics (Expérience clinique des diverses anesthésies). *Anes. et anal.*, 1939, 5: 11.

Christophe states that of 12,000 operations, approximately 2,500 were done with nitrogen protoxide, 1,500 with sodium evipan, and the rest with ether and local or regional anesthesia; spinal anesthesia and avertin alone were rarely used.

On the basis of his experience he concludes that chloroform should never be used, and spinal anesthesia only rarely. Ether is the most important anesthetic so far, but with continued experience it may gradually lose this prestige in favor of evipan given intravenously. Such anesthetics as nitrogen protoxide, ethylene, or cyclopropane have become less necessary as evipan anesthesia has developed. However, the author has found that nitrogen protoxide given by the intratracheal method under pressure is of definite value in intrathoracic operations.

Intravenous anesthesia, the author believes, will become of increasing importance and tend to displace the use of other anesthetics in the great majority of cases. Very likely a better intravenous anesthetic than evipan may be found, but at present Christophe has found it one of the most satisfactory anesthetics at his disposal. The technique of its administration demands careful study and attention to each detail. The surgeon must understand the use of this anesthetic and direct the anesthetist as to when and how much to inject as the operation proceeds. The first injection of evipan must be given slowly, but not with the extreme slowness advocated by some surgeons; the initial dose varies from 1 to 4 c.cm., according to the age and condition of the patient; only young men in good general condition require the larger dose. When the patient is asleep, his reaction to pinching the skin with a small forceps should be determined; if there is a reaction, another 2 c.cm. of evipan should be given, and the surgeon should wait at least three minutes before beginning the incision. Further injections of from 1 to 2 c.cm. of evipan may be given as the surgeon deems necessary for the maintenance of the degree of anesthesia desired. The only absolute contraindications to the use of evipan are buccopharyngeal infections and jaundice. Otherwise evipan may be used to advantage in all types of operations; the author never saw a serious complication from the use of evipan and never used artificial respiration in the 1,500 operations done under this anesthetic.

ALICE M. MEYERS.

SURGICAL INSTRUMENTS AND APPARATUS

Bates, R. R.: Studies on the Absorbability of Catgut. *Am. J. Surg.*, 1939, 43: 702.

Catgut is the most popular suture material, but there exists a wide variance in opinion as to the type and size of catgut to be used for any given purpose. An experimental study was undertaken to evaluate the size and type of catgut that caused the least inflammatory reaction in the tissues, yet remained long enough for holding purposes and did not interfere with proper healing.

The various sizes and types of catgut were used to suture gastro-enterostomies and abdominal wounds in adult dogs. The sutured structures were examined grossly and histologically at intervals of one, four, seven, fourteen, and twenty-eight days. Plain and chromic catgut sutures were used in sizes 000, 1, and 3.

It was found on the one hand that plain catgut excited a prompt and violent exudative reaction and delayed the appearance of fibroblasts. Furthermore, the large sizes of plain catgut were absorbed practically as fast as the small size, and none of the plain catgut lasted more than four days. On the other hand, chromic catgut in all sizes produced comparatively little tissue reaction, and fibroblasts appeared early (four days). Small chromic catgut functioned as long as or longer than the large sizes, and wound support and healing were more satisfactory when 000 chromic catgut was used. The findings were essentially the same in the abdominal wall as in the gastro-intestinal tract. LUTHER H. WOLFF, M.D.

Taylor, F. W.: Surgical Knots and Sutures. *Surgery*, 1939, 5: 498.

The surgical knot is one of the more fundamental elements of surgery, and until recently the scientific approach to the knot problem has been neglected. The author, by experimental methods, has demonstrated a number of interesting phenomena with regard to knots, particularly knots which are subjected to tension. The knot is the weakest point of a suture, not only because of the possibility of a defective knot, but also because the tying of a knot tends to weaken fibers in the material adjacent to it.

The holding power of a knot is largely dependent upon the friction of one suture strand upon another. A coefficient of friction values for the various types of suture, both wet and dry, was determined. As one would anticipate, the serum-proof sutures, such as silkworm gut, dermal, and wax-impregnated silk, generally had the lower friction values and were little affected by wetting. Ordinary braided silk, linen, and plain and chromic catgut, however, showed a marked increase in friction values when wet. In spite of the increased friction value of wet catgut, it is a matter of common observation that wet catgut is more slippery than dry, and knots tied with wet catgut have a greater tendency to slip out. The author gives two explanations for this apparent paradox: (1) wet catgut stretches and prevents the tying of hard knots, and (2) wet catgut, especially the boilable type, swells as it takes up moisture, and the knot tends to loosen as a result of this swelling. The author favors the smaller sizes of suture material, since the strands can be tied more tightly together.

What type of knot is the most reliable? The author tested the various types of suture material by means of a knot-testing apparatus, and also by tying knots under regulated tension, and arrived at some interesting conclusions. A carefully made square knot is reliable only when using ordinary silk or linen. A "surgeon's knot" is definitely less reliable than a square knot, a third throw being imperative when this knot is used. A triple-throw knot is the safest of all simple knots, but at least 2 of the throws should be square. Frequently "square" knots tied with one hand are not pulled down flat and as a result are useless. If differences in bulk occur (such as those present when 2 strands are tied to a single strand at the end of a running suture), or if one component is less pliable than the other, it is very difficult to tie a flat square knot; hence, a quadruple throw knot is recommended when wet catgut or waxed silk is being used. The cut ends of a knot should be left fairly long, because of the tendency of knots to slip a bit, or roll. Catgut suture ends should be left at least 6 mm. long, and suture ends of silk (small size) should be 3 mm. long. Knots tied with chromic catgut are definitely more secure than those tied with plain catgut. Serum-proof silk, although exceptionally satisfactory in many respects, has the disadvantage of being particularly prone to knot slips because of its low friction value. Extreme care must be used in tying this material.

The personal element of the operator himself is a factor in knot reliability, and the author advises that particular caution must be taken with all knots subject to stress. LUTHER H. WOLFF, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Newcomer, N. B.: The Joint Changes in Hemophilia. *Radiology*, 1939, 32: 573.

The recognition of hemophilia as a cause of joint changes is stressed. It is of great importance that the profession be reminded that approximately 80 per cent of hemophiliacs have significant articular abnormalities which are due to the disease.

The literature on hemophilia is carefully reviewed. Some authors have attempted to classify the joint involvement in several stages, but it would appear that the author's two-stage classification, viz., (1) the stage of acute hemorrhage into the joint, and (2) the chronic stage in which changes in the joint are produced by these hemorrhages, is highly practical. Thomas, in a review of 98 cases of hemophilia, found that 78.5 per cent of the patients gave a history of joint involvement, while 61.2 per cent had permanent joint deformity. Of the joints involved, the knee was by far the most commonly affected (in 68 per cent). The order of frequency of involvement of other joints was: ankle, 56, elbow, 53, hip, 16, fingers, 15, wrist, 5, and toes, 2 per cent. The shoulder, more than any other joint, seemed to have escaped permanent deformity. The spine was involved in 3 cases. The appearance of the joints varies according to the stage of the disease. In the hip, Perthes' disease may be simulated. In general the picture varies from periarticular swelling, due to hemorrhage, to an appearance of osteo-arthritis with lipping of articular margins, bony osteophytes, due to destruction of articular cartilage; limitation of motion in varying degrees; and regional muscular atrophy. Bone destruction may vary from punched-out areas in the epiphysis without disturbance of the articular surfaces, to destruction of the articular surface with localized rounded areas of destruction extending into the epiphysis. Organization of blood clots may be shown by calcification.

Three cases were reported in some detail. The first, that of a male of sixteen, had given evidence of

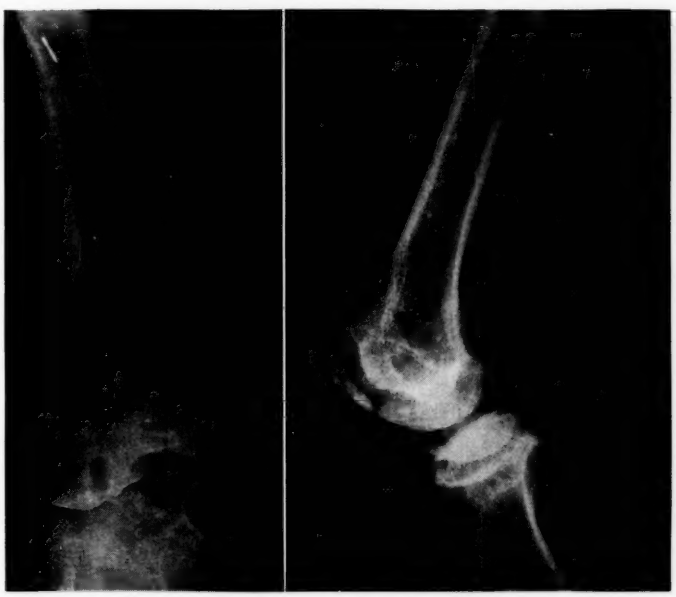

Fig. 1 Fig. 2

Figs. 1 and 2. Anteroposterior and lateral views of the left knee. There is a widened and deepened intercondyloid notch, a punched-out area above the external condyle, flattening of both tubercles of the spine of the tibia, and irregularity of the articular surface of the internal tuberosity. There is rarefaction of both condyles of the femur, and a small exostosis on the anterior surface. There is rarefaction of both tuberosities and of the patella.

hemophilia since the eleventh day of life. Joint symptoms appeared at the age of five, when the joints of the right arm became involved. At the time of examination, roentgenologically demonstrable lesions were found in the left elbow, wrist, and hand; the right wrist; and the left knee. The second patient, a male of fifty-six, had had episodes of bleeding since infancy, and presented demonstrable changes in the right knee and in both ankles, as well as in the right elbow. The third patient, like the 2 others, presented an excellent family and personal history of hemophilia. Joint symptoms were noted at the age of ten. Roentgen changes were found in both knees, both elbows, and the right shoulder and hand. The accompanying illustration demonstrates very well the widening of the intercondyloid notch, punched-out areas in the lateral condyles, and irregularity of the articular surfaces which were found in the radiograph of the left knee. HAROLD C. OCHSNER, M.D.

Caldwell, W. E., Moloy, H. C., and Swenson, P. C.: The Use of the Roentgen Ray in Obstetrics. *Am. J. Roentgenol.*, 1939, 41: 305, 505, 719.

In a series of three papers, a review of the roentgen methods of study of the female pelvis and the fetal head as an aid to obstetrical prognosis has been presented. The objectives of roentgen examination are two: to determine (1) whether the bony pelvis is large enough to permit the fetal head to descend safely, and (2) *how* it may descend provided the pelvis is large enough to receive it. Opinions differ as to the importance of these two objectives. Some workers believe the first to be more important and consequently make use of procedures which give accurate measurements of the pelvis and fetal head. The diameters of the bony pelvis are more easily obtained by roentgen methods than are the cephalic diameters. The volumetric method proposed by Ball seems to place the estimation of head size upon an accurate basis. The sizes of the pelvis and the head being determined however, in many cases a prognosis as to ease or difficulty of labor cannot be made with reasonable assurance for several reasons. The ability of the head to flex and mold with efficient uterine contractions and so to overcome even a major degree of disproportion cannot be estimated. Errors in prognosis may occur through the use of the smallest pelvic diameter as the index of pelvic capacity. In a few pelves, depending upon their shape, the smallest diameter *is* the index of pelvic capacity; in others, with the same smallest diameter, an easy labor may occur because in other diameters compensatory space exists which the head may utilize. However, more experience in the interpretation of pelvic type may, in the future, increase the accuracy of the obstetrical prognosis as approached by means of methods which give quantitative diagnostic information.

The second prognostic objective is concerned with fetal pelvic relationships during labor and with the manner in which the head engages and descends, and is important in all cases whether or not variable degrees of disproportion exist. Certain roentgen techniques from which accurate measurements of the pelvis and fetal head may be obtained from single anteroposterior and lateral films are not entirely satisfactory for the study of pelvic shape and fetal-pelvic relationships. For this purpose stereoscopic anteroposterior films, in addition to a lateral and a subpubic arch view, have been found more satisfactory. A suitable technique for making the stereoscopic films, which includes a practical modification of a stereoscopic method of measurement (the so-called "phantom image" method) has been developed. By means of the precision stereoscope, diameters of the pelvis and fetal head may be measured accurately enough for practical purposes, and the pelvic shape and fetal-pelvic relationships can be studied at the same time.

To interpret the roentgenograms, the roentgenologist must acquaint himself with the problems which concern the obstetrician; namely, the size and shape of the maternal pelvis, the position and axis of the fetal head, and the existing degree of flexion, extension, or molding. These are the factors, along with the uterine and pelvic soft parts, which control the mechanism of labor. It is difficult to describe rules to follow in the interpretation of the roentgenograms with regard to the manner in which the head descends. However, an attempt has been made to show how a knowledge of pelvic shape and fetal-pelvic relationships may be applied to advantage in the management of labor and in the treatment of pelvic arrest.

CONCLUSIONS

The following conclusions seem justifiable:

(1) The study of stereoroentgenograms, augmented by a lateral view and an anteroposterior view of the subpubic arch, makes possible a complete description of the shape of the pelvic cavity from inlet to outlet and leads to a classification upon the basis of morphology.

(2) The size of the pelvic diameters as determined by measurement of the phantom image in the precision stereoscope and an approximate estimate of the degree of disproportion may be gained by using the image of the fetal head as the yardstick of measurement. Any other method of roentgen pelvimetry may be used, including the comparison of head volume to pelvic size.

(3) The recognition of ample pelvic capacity and absence of disproportion gives negative evidence of value to the obstetrician, but such evidence does not preclude the possibility of soft-part dystocia.

(4) With increasing experience, the probable mechanism of labor for the pelvic type may be suggested.

(5) A knowledge of the size and shape of the pelvis and the fetal-pelvic relationships aids in the management of labor by indicating the regions where the most available space exists. In certain instances this compensatory space may be made

available to the fetal head by manual or instrumental methods.

(6) In the event of arrest of the fetal head, a knowledge of pelvic shape and the existing fetal-pelvic relationship aids in showing how the best operative procedure may be employed.

(7) Positive prognostic statements as to the outcome of labor should be avoided except in rare instances, because too many immeasurable factors, which cannot be visualized by the roentgen ray, are involved.

(8) A roentgenological examination is useful in the teaching of the mechanism of labor to the resident and intern staff of obstetrical clinics. In the discussion of difficult individual deliveries a knowledge of the pelvic type as revealed by a roentgenological examination is necessary in order to appreciate fully the cause of the difficulty encountered.

(9) The obstetrician must acquaint himself with the visual appearance of the common obstetrical difficulties with which he is familiar. The roentgenologist and obstetrician must cooperate in an effort to correlate the roentgenological and clinical data in each case to obtain more practical information from the roentgenograms.

Nordentoft, J. M.: The Conservative Treatment, with Barium Enema, of Intussusception in Children. *Acta radiol.*, 1939, 20: 128.

The treatment of intussusception in children by means of barium enemas with fluoroscopic control has been reported by various authors, but the method does not seem to have met with universal favor. With a view toward determining the certainty with which intussusceptions in children could be reduced by the roentgen method, the author reviews 440 cases observed from 1928 to 1935. The procedure was employed in about half of all the cases in this group, and complete reduction was obtained in about half of the cases in which it was used.

Use of the method has increased very materially; whereas it was employed in only 34 per cent of the cases during the first four years of the period under investigation, 64 per cent were subjected to it during the latter four years. Study of the series revealed that nearly all cases of intussusception of the large intestine coming under treatment within the first twenty-four hours can be reduced conservatively by the barium-enema method. A careful technique with adequate constant pressure is necessary for successful results. The need for repeated roentgen examinations to determine successful reduction is stressed. The advantages and drawbacks of the roentgenological method are discussed briefly.

ADOLPH HARTUNG, M.D.

MISCELLANEOUS

Hollaender, A.: The Present Status of Mitogenetic Radiation. *Radiology*, 1939, 32: 404.

Mitogenetic rays are reported to be the ultraviolet radiation of wave lengths from 1,900 to 2,600 Å., of an intensity of from 10 to several thousand quanta /cm.2/sec., and are said to be emitted by many biological materials and by chemical reactions. This radiation is supposed to cause increased cell division in certain biological materials, to initiate or speed up certain enzymatic reactions, and to cause the emission of so-called secondary radiations in many biological materials which are themselves not able to emit primary radiation.

This article is a review of a few details of the characteristics of mitogenetic radiation, and the procedures in its detection and manipulation. An attempt is made to determine whether mitogenetic radiation is a well established scientific phenomenon, and if its existence can be proved by any investigator, with proper training, who uses the appropriate procedures.

Detailed descriptions of the biological and physical methods reported by various workers are given. In spite of the fact that a majority of the more than 700 publications on the subject imply that the use of biological detectors is a simple, well-outlined procedure, which may be reproduced by anyone acquainted with fundamental biological technique, the author believes that such confidence is not justified, since it ignores conflicting findings. From the results obtained with physical detectors to date, it would appear also that the existence of mitogenetic radiation has not been proved by them. Although extensive reviews on the application of mitogenetic analysis to many biological problems are available, an evaluation of the results of the use of these methods must await further investigations.

ADOLPH HARTUNG, M.D.

SURGICAL CONSIDERATION OF AMEBIASIS

Collective Review

ALTON OCHSNER, M.D., F.A.C.S., and MICHAEL DeBAKEY, M.D., New Orleans, Louisiana

AMEBIASIS is of surgical significance because it may produce intestinal manifestations which are identical with those of other bowel lesions amenable to surgical therapy, and because extra-intestinal invasion of the body by entamœba histolytica may produce lesions which necessitate surgical intervention. While it is the general impression that amebiasis occurs principally in warmer climates, the investigations of Craig (14) and others (61) demonstrate conclusively that amebiasis occurs ubiquitously. In a series of 49,336 persons examined in all parts of the United States as collected by Craig (14), 5,720 (11.6 per cent) were found to be infected with entamœba histolytica. Craig (15) also found, in examining 189 physicians from all parts of the United States, entamœba histolytica in 12.7 per cent. The incidence of amebiasis is increasing as evidenced by the authors' (61) analysis of collected cases. In a collected series of 19,882 individuals who were examined before 1930 there were 2,058 (10.3 per cent) with positive infection; in a similarly collected group of 28,634 individuals examined since 1930, there were 3,692 (12.8 per cent) with positive infection (61). The authors estimated that between 300,000 and 600,000 people in the United States have amebic hepatic abscess. *As hepatic abscess represents only about half of the complications of amebiasis of surgical significance, it is evident that a conservative estimate would be that from 500,000 to 1,000,000 people in this country are so affected.* This appallingly high figure emphasizes the necessity of serious consideration of amebiasis by surgeons.

Amebic lesions of surgical significance may be classified as follows:

1. Intestinal lesions
   a. Appendicitis
   b. Perforation with resulting peritonitis
   c. Massive hemorrhage
   d. "Ameboma" (Amebic granuloma)
   e. Cicatricial stenoses
   f. Pseudopolyposis
2. Extra-intestinal lesions
   a. Hepatic abscess
   b. Pleuropulmonary affections
   c. Cerebral abscess
   d. Cutaneous ulceration and abscess
   e. Splenic abscess
   f. Genito-urinary affections

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From the Department of Surgery, School of Medicine, Tulane University, New Orleans, Louisiana.

INTESTINAL LESIONS

In a previous communication (52) the surgical significance of amebic appendicitis was emphasized. It is our belief that one of the most frequent surgical complications of amebiasis is amebic appendicitis which may occur as an acute, suppurative, or chronic inflammatory process. The lesion, however, is likely to be overlooked unless the physician considers the possibility of its existence. This is true particularly in low-grade, chronic infections in which the correct diagnosis is missed unless careful examination of the feces is made. The frequency of acute, amebic, inflammatory processes in the appendix is demonstrated by the investigations of Clark (12), Strong (74), and Craig (16), who obtained incidences of suppurative appendicitis in fatal cases of amebiasis of 7 per cent, 40 per cent, and 16 per cent, respectively. Acute infection of the appendix occurring during the course of an amebic infection of the bowel is more likely to be suspected pre-operatively than are the subacute and chronic inflammations produced by entamœba histolytica. From our experience, however, we believe that amebic infections of the appendix producing mild symptoms are common. So frequently does this condition exist that it is a rule in our clinic to have careful stool examinations for entamœba histolytica in all patients in whom a diagnosis of chronic appendicitis is made. Probably the appendiceal infection is only a part of the more or less generalized involvement of the intestinal tract. In approximately 10 per cent of these cases the parasite is found, and in most instances anti-amebic therapy is sufficient to bring about a relief of all symptoms and signs. Wilkinson (84) believes that chronic amebiasis and chronic appendicitis may so simulate each other that they must always be differentiated. Huard (37) is of the opinion that amebic appendicitis

occurs frequently enough to deserve consideration in every patient with pain in the right iliac fossa, particularly if that patient gives a history of having had an antecedent dysentery. However, the absence of a history of diarrhea in no way rules out the possibility of amebiasis, because, as emphasized by Craig (14), dysentery is only one manifestation of amebic invasion of the bowel and one which is not infrequently absent. Craig (14) states: "It is most unfortunate that the term 'amebic dysentery' should have become in the minds of most medical men as a synonym of amebiasis or amebic infection, for while dysenteric manifestations are quite characteristic of the serious infection of entamœba histolytica, the vast majority of such infections are not accompanied by dysenteric symptoms, but by milder symptoms usually attributed to some other factor and not recognized as a result of infection with the parasite."

The clinical manifestations of chronic amebic appendicitis are indistinguishable from those produced by chronic pyogenic infections of the appendix. In our experience constipation has been present far more frequently than diarrhea in both types of appendiceal involvement. In all patients with manifestations of chronic infections of the appendix in whose stools amebas are demonstrated or in whom the complement fixation test for amebiasis is positive, the use of amebicides is imperative. In subacute infections of the appendix conservative treatment is justified, although one should be cautious about the use of those amebicides which produce intestinal irritation. In such instances it is preferable to use emetine, because this exerts a definite amebicidal action, but does not irritate the intestine, nor increase its peristalsis.

In acute amebic appendicitis, in addition to anti-amebic therapy, absolute conservatism is essential, as employed and previously described (53, 54) in the treatment of pyogenic appendiceal peritonitis. Any operative manipulation is undesirable and dangerous in acute amebic inflammations of the appendix because the infection is seldom if ever limited to the appendix but involves the cecum as well. This danger was demonstrated by the prohibitive appendectomy mortality rate which followed the Chicago epidemic. However, appendectomy is necessary occasionally.

In the rapidly progressive case of intestinal amebiasis perforation of the bowel may occur. The incidence of this complication varies considerably in clinical and autopsy series. Strong (75) found intestinal perforation in 19 per cent of fatal cases of amebiasis, whereas it was observed in only 1.5 per cent of clinical cases. On the other hand, Craig (14) found the incidence in fatal cases of amebiasis to be only 4 per cent. The prognosis in most cases of amebic intestinal perforation is grave because peritonitis almost invariably follows and little or nothing can be accomplished by surgical intervention.

Although generalized peritonitis which is likely to end fatally will usually result from the perforation of an amebic ulcer into the free peritoneal cavity, localized peritoneal infections with the development of walled-off peritoneal abscesses occur more frequently, particularly in the regions of the cecum and the sigmoid. In contrast to chronic intestinal amebiasis in which constipation is usually present, in these cases dysentery is often a prominent manifestation, although as Craig (14) has emphasized, there may be a history of repeated diarrheal attacks. As the condition is localized, surgical intervention is not urgent and amebicides (emetine) should be used as a preliminary measure. Following the pre-operative administration of amebicides, incision and drainage of the abscess is indicated without prolonged delay in order to prevent possible perforation of the abscess into adjacent viscera, into the free peritoneal cavity, and into the extraperitoneal areas.

Massive intestinal hemorrhage is a rare complication of amebiasis. Strong (76) reports 2 cases in which intestinal hemorrhage was a fatal complication. Craig (14) refers to 2 cases in which hemorrhage was the cause of death in the recent Chicago epidemic. Treatment of massive intestinal hemorrhage should be ultraconservative and consists of the use of amebicides, and massive and repeated transfusions in order to replace the lost blood and to increase the blood coagulability. In massive hemorrhages the mortality is extremely high.

Infrequently, as a result of repeated invasion of the bowel wall by the amebas with consequent fibrous-tissue reaction, tumefaction occurs. The growth has been referred to as amebic granuloma, but in the authors' opinion "ameboma" is preferable and more expedient. Cases of this nature have been reported by a number of authors (3, 5, 23, 30, 31, 39, 42, 78). "Amebomas" are most likely to occur in the cecum or in the sigmoid and are characterized by progressive destruction of the bowel wall and replacement with fibrous tissue. Small abscesses may be present in the more central areas. The firm, nodular inflammatory mass is usually fixed to adjacent structures by fibrous tissue surrounding the tumor. The mucous membrane is largely destroyed and the base of

the resulting ulcer is covered with dirty grayish slough. Microscopically, amebas are demonstrable particularly in the necrotic tissue at the base of the ulcer. There is considerable round-cell infiltration and lymphoid hyperplasia. Eosinophiles are present in large numbers. Fibroblastic proliferation becomes more prominent in the peripheral portions of the mass. "Amebomas" are likely to be confused with tuberculomas, and actinomycotic and malignant lesions. In all chronic, inflammatory lesions involving the cecum particularly, one should consider the possibility of "ameboma" and attempt to exclude it by careful stool and serological examinations. In those cases in which amebas are found the use of amebicides is imperative before any surgical intervention is done. In many cases because of extensive cicatricial narrowing consequent to healing, short-circuiting operations or resections may be necessary to restore normal bowel function. If the active amebiasis has not been controlled before such a procedure is attempted, extension of the amebic infection to the peritoneum or the abdominal wall is quite likely to occur postoperatively.

Cicatricial stenoses of the colon may occur either locally in a particular segment or throughout the entire extent of the bowel. Craig (14) has called attention to the fact that at post mortem occasionally a generalized narrowing of the colon may be found. Particularly in patients who have had symptoms over long periods of time with recurrent infection is cicatricial narrowing of the bowel likely to occur, the result of destruction of the bowel wall and replacement by fibrous tissue. Probably the reason that more stenoses do not occur is that the lesion in amebiasis is limited characteristically to relatively discrete areas of mucosa and submucosa. In those instances in which cicatricial narrowing does occur it is probably the associated secondary infection engrafted upon the amebic infection which is responsible for greater destruction of the bowel wall. Recently Christopher (10) reported a case of extensive cicatricial narrowing of the large bowel extending from the cecum to the sigmoid which was successfully treated by multiple-stage resection of the bowel. It is of interest that the patient's first symptoms were those of "ameboma" involving the cecum. Exploration of the abdomen revealed a localized abscess above the ileocecal valve and also a large inflammatory mass involving the cecum. In the purulent discharge from the abscess amebas were found. The treatment of amebic cicatricial stenoses of the bowel consists first of the administration of amebicides in those cases in which the amebic nature of the condition is established, and later either excision of the stenotic bowel or short-circuiting around the stenotic obstructed area. A case of "ameboma" treated successfully by the use of amebicides has recently been reported by Uzac and Timbal (81). The tumor in this instance involved the rectosigmoid. Rarely such structures may be limited to the rectum. Travassos (80) was able to find only 2 proved reported cases and added 2 of his own. In rectal strictures careful dilatation of the stricture is justified.

As a result of the long-continued infection, hypertrophy of the colonic mucosa may occur and result in pseudopolyposis of the bowel. Hines (36), and Anderson *et al.* (1) report cases in which following prolonged amebic infection there resulted pseudopolyposis of the entire colon. Anderson's (1) patient recovered following a two-stage resection of the large bowel.

EXTRA-INTESTINAL LESIONS

From a surgical therapeutic standpoint the most important amebic lesion is hepatic abscess. In previous studies (61) the authors found that of 4,994 fatal cases of amebiasis collected from the literature 1,818 (36.5 per cent) presented hepatic abscess. The lowest incidence in this group was 7.6 per cent (11), and the highest was 84.4 per cent (73). The incidence of hepatic abscess in all cases of amebic dysentery varies considerably. In a group of 9,039 collected cases of amebiasis including the authors' there were 4,030 cases of amebic abscess of the liver, an incidence of 4.7 per cent (61). In the Charity Hospital group of the authors' series there were 118 amebic hepatic abscesses among 676 cases of amebic dysentery, an incidence of 17.4 per cent. Curiously enough the incidence has increased during the past few years in this institution. During the six-year period from 1928 to 1933, inclusive, the incidence of hepatic abscess in amebic dysentery was 15.2 per cent (55), whereas in the period from 1934 to 1937, inclusive, this figure was 20.4 per cent (61). This recent increase in incidence is due either to the fact that more cases are being diagnosed or to the actual increase in liver complications. Undoubtedly, as Craig (14) has emphasized, many cases remain undiagnosed, especially in temperate climates where amebiasis is still considered a tropical disease. Craig has on numerous occasions found an amebic abscess of the liver at autopsy which was absolutely unsuspected before death.

Amebic hepatic abscess occurs predominantly in males. In a series of 1,487 collected cases, the

authors found that 1,418 (95.3 per cent) occurred in males. In the authors' series of 139 cases there were 119 (85.4 per cent) in the male sex. There are several factors that are responsible for the greater incidence of amebic hepatic abscess in the male. The fact that amebic infection of the bowel occurs more frequently in the male predisposes to the development of hepatic infection. Rolleston (71) has suggested that this is explained by the greater incidence of alcoholism which predisposes to hepatitis and the greater likelihood of trauma in the male.

Amebic hepatic abscess is a condition of adult life, most of the cases occurring between twenty and fifty years of age. In the authors' series of 139 cases, 17.9 per cent occurred in the third decade, 29.4 per cent in the fourth, and 25.8 per cent in the fifth decade. The youngest patient was six years and the oldest was seventy years, the average age being about forty years. Over 55 per cent of the cases occurred between the ages of thirty and fifty. It is of interest that the average age in our series is approximately a decade older than in the tropical cases, which is probably due to the fact that in the tropics amebiasis occurs more frequently and in younger individuals. There was little difference in the racial incidence in our series. Of 118 cases admitted to the Charity Hospital, 50.8 per cent occurred in white and 49.1 per cent in colored patients.

Amebic hepatic abscess is the result of the invasion of the liver parenchyma by amebas following their transportation from the colon through the portal system. It is our opinion that because many cases of hepatic abscess are unassociated with diarrheal manifestations, lesions of the right side of the colon are more likely to give rise to amebic hepatic abscess than those on the left side, probably because of the fact that lesions on the left side produce dysenteric manifestations which direct the attentions of the patient and the physician toward the bowel lesion and result in the institution of adequate therapy of the amebic intestinal infection. In those instances in which the infection is limited to the right side of the colon, the intestinal lesion is likely to be silent and permit invasion of the portal system by the amebas and extension to the liver, without the true diagnosis being suspected. Following invasion of the hepatic parenchyma by amebas there results an amebic hepatitis which if allowed to progress may produce liquefaction necrosis of the parenchyma. According to Craig (14), amebas exert a lytic action on liver cells. The condition is in reality not a true abscess but a liquefaction necrosis. If prompt therapy is instituted during the stage of amebic hepatitis no destruction will occur and complete restitution will be obtained.

The majority of amebic abscesses of the liver are single. In 1,403 cases the authors (61) found that 68.6 per cent were single and 31.3 per cent were multiple. In 99 of the authors' personal cases, 87.8 per cent were single and 12.1 per cent were multiple. The right lobe is more frequently involved than the left. In the collected series the right lobe was involved in 83.8 per cent and the left in 16.1 per cent; in the authors' personal series these percentages were 95.9 per cent and 4 per cent, respectively. The content of an amebic abscess consists of necrotic liver tissue which accounts for the characteristic chocolate-sauce appearance of the material obtained from such an abscess. Amebas are seldom present in the liquefied material, but are frequently present in the wall. In 289 collected cases amebas were present in the pus in only 16.9 per cent. In 77 personal cases amebas were present in the pus in only 15.5 per cent. Most amebic abscesses of the liver are sterile, as shown by an analysis of 448 collected cases in which the abscess was found to be sterile in 86.3 per cent. In 77 personal cases the abscess was sterile in 84.5 per cent. While the amebic hepatic abscesses are usually sterile, they quickly become infected after open drainage, the significance of which will be discussed under therapy.

The clinical manifestations of amebic hepatic abscess may be divided into two groups: systemic and local. In contrast to pyogenic abscess of the liver the symptoms and signs are less clearly defined than one would expect from the degree of hepatic destruction. By far the most frequently encountered clinical manifestations are pain in the right upper quadrant of the abdomen and tenderness over the liver. In our series these manifestations were present in 85 per cent. So convinced are we of the importance of right upper abdominal pain that we believe that in every patient with this manifestation with hepatic enlargement the possibility of amebic hepatitis should be considered and excluded. Fever is almost as frequently encountered, in 83 per cent in our series. Characteristically, pyrexia is not marked. The usual range is from 99 to 101 degrees F. unless secondary infection of the abscess occurs. Enlargement of the liver was present in 72 per cent of our cases. Weakness and loss of weight were the next most frequently encountered symptoms, being present in 52.5 and 42.4 per cent, respectively. Diarrhea was a manifestation at the time of admission to the hospital in only 21.5 per cent, which demonstrates the danger of placing too much importance on dysentery as a symptom in

amebic hepatic abscess. Chills were present in 17 per cent, nausea and vomiting in 15.7 per cent, and jaundice in only 7.8 per cent. Of diagnostic significance is the fact that a patient with uncomplicated amebic hepatic abscess does not appear to be acutely ill. He has the appearance of one who has a low-grade infection which has been present for some time. This is in direct contrast to the clinical appearance of a patient with a pyogenic hepatic abscess. In addition to the local manifestations, such as liver tenderness and enlargement of the liver, there is frequently localized bulging at the site of the abscess. This is likely to occur particularly on the right side just beneath the costal margin. The clinical manifestations vary in different cases. We have arbitrarily divided the cases into two groups: those with symptoms that have existed less than three weeks have been considered acute abscesses, whereas those with symptoms that have existed three weeks or longer have been considered chronic abscesses. Of 66 cases in which the duration could be determined, one third were acute and two thirds were chronic. The average duration in the acute cases was thirteen days and that in the chronic one hundred and thirty-three days.

The laboratory findings in amebic hepatic abscess are significant because they differ so from those of pyogenic liver abscess (62). The authors' findings (22, 55, 56, 61) agreed with those of Rogers (67, 68, 69), and Manson-Bahr and Willoughby (45) in that the increase in the polymorphonuclear leucocytes was only moderate and that there was not the disproportionate increase in the polymorphonuclear leucocyte count that is found in pyogenic hepatic abscesses. In our series (61) the lowest leucocyte count was 4,250, the highest 31,500. The neutrophilic percentages were as follows: lowest 59, highest 97, and the average 78. A considerable elevation of the total leucocyte count associated with a marked increase in the polymorphonuclear percentage indicates secondary infection of the abscess cavity. The lowest erythrocytic count was 1,950,000, the highest 4,975,000, and the average, 3,700,000. The corresponding hemoglobin percentages were 35, 90, and 65. In all suspected cases of amebic hepatic abscess careful repeated stool examinations should be made. Although the presence of entamœba histolytica in the stool is of diagnostic importance, its absence in no way excludes the diagnosis of amebic hepatic abscess. This undoubtedly is due to the fact that the antecedent intestinal infection is healed after invasion of the liver has occurred. In the collected series of 209 cases of amebic hepatic abscess, the stools were positive in only 18.1 per cent, whereas in the authors' 72 cases amebas were found in the stools in 30.5 per cent.

Of great diagnostic value in amebic hepatic abscess is the complement fixation test of Craig (17, 18). This test was positive in every case of proved amebic hepatic abscess in which it was used.

One of the most important and reliable aids in the diagnosis of liver abscess is roentgenography. With few exceptions the characteristic manifestations of hepatic abscess as described by Granger (29) and the authors (57) have been present in our series. These consist of a localized bulging of the diaphragm into the lower lung field in uncomplicated hepatic abscess. In those cases in which amebic hepatic abscess has ruptured into the subphrenic space there is characteristically an obliteration of the cardiophrenic angle, that is, elevation of the medial portion of the diaphragm in anterior posterior roentgenograms, and obliteration of the anterior costophrenic angle in lateral roentgenograms. This is because of the medial and anterior locations of the abscess in the subphrenic space. The anteromedial location of these collections of fluid characteristically is different from that of pyogenic infections which is posterior and lateral (58). Roentgenograms of the latter infections show elevation of the diaphragm in the lateral portion and obliteration of the costophrenic angle, rather than the cardiophrenic angle in anterior posterior roentgenograms, and obliteration of the posterior rather than the anterior costophrenic angle in lateral roentgenograms. The diagnostic importance of roentgenographic examination is illustrated by the percentages of correct diagnoses. In the collected series the x-ray findings were positive in 83.3 per cent; in our own series this percentage was 88.5 (61).

The diagnosis of amebic hepatic abscess is not difficult if the physician will merely consider the possibility of its existence. Probably the most important reason that a correct diagnosis is not made is that many physicians still consider amebiasis as a tropical disease, do not sufficiently realize the ubiquitous distribution of this infection, and are not cognizant that amebic hepatic abscess can occur in the absence of diarrhea. In a patient with persistent enlargement of the liver associated with slight pyrexia one should always consider the possibility of amebic hepatic infection. The presence of a moderate leucocytosis without a concomitant proportionate increase in the polymorphonuclear leucocytes is of diagnostic importance. A history of previous diarrhea is confirmatory, but was present in only two-thirds of

our cases. The fact that only 1 of 5 of our patients had diarrhea at the time of admission is dramatic proof that concomitant diarrhea is unnecessary for the diagnosis of amebic hepatic abscess. In addition to the clinical history, the classical roentgenographic findings and positive complement fixation test are the most important diagnostic aids. The presence of a positive complement fixation test is evidence of an amebic infection, and in a patient with hepatic enlargement is indicative of amebic hepatitis which may or may not have progressed to abscess formation. Probably of greatest diagnostic importance is exploratory aspiration of the abscess. As in 84.5 per cent the aspirated material was sterile, the site of aspiration might seem of little consequence. Because, however, 15 per cent of the cases showed the presence of pyogenic microorganisms, we believe that aspiration should be done in such a way as to prevent possible contamination of uninvolved serous cavities. We believe, too, that the aspiration should be done in the operating room, because in those cases in which pyogenic organisms can be demonstrated, which usually can be suspected before the aspiration by the marked pyrexia and leucocytosis, open drainage should be done. In abscesses located posteriorly the needle should be introduced below the costophrenic angle and directed upward toward the abscess. In order to prevent possible contamination, the pleural cavity should not be traversed by the needle. Anteriorly located abscesses are approached beneath the costal margin, the needle being introduced directly into the abscess. Aspiration of characteristic chocolate-sauce pus is of diagnostic importance, and is considered almost pathognomonic of amebic hepatic abscess. As mentioned, smears of the aspirated material should be examined in the operating room to determine the presence or absence of pyogenic organisms. Cultures should always be made.

The prognosis in amebic abscess of the liver depends upon a number of factors: (1) multiplicity of the lesions in the liver, which in turn are dependent upon the severity of the amebic infection; (2) general resistance of the patient; (3) secondary infection of the abscess cavity; and (4) the type of treatment employed. The gravity of the multiplicity of lesions is apparent in our statistics. In 12 cases in which the amebic hepatic abscesses were multiple the mortality rate was 100 per cent, whereas in 87 cases in which the abscess was single the mortality rate was 11.4 per cent. Secondary infection of amebic hepatic abscess greatly increases the gravity of the condition. This is well illustrated by those cases in which secondary infection of the amebic abscess follows open drainage. The patient does not appear ill before the institution of open drainage; he has a temperature ranging between 99 and 101° F. and a leucocyte count of approximately 13,000; however following the institution of open drainage he appears to be acutely ill, his temperature rises to 104 or 105° F., and the leucocyte count increases to 20,000 or 30,000. This observation is substantiated by the results obtained following open and closed drainage (61). In 4,760 collected cases in which open operation was done, the mortality rate was 44.2 per cent, whereas in 457 similar cases in which aspiration and amebicides were used, the mortality rate was 6.7 per cent. These respective figures in our own series were 21.6 per cent and 3.6 per cent. Complications of amebic hepatic abscess, which consist largely of infection, completely alter the prognosis. In our series the mortality rate in 33 cases with complications was 39.4 per cent, whereas in 106 cases with no complications the mortality rate was 8.4 per cent.

The prognosis in amebic hepatic abscess is also dependent upon the type of therapy instituted. As indicated above, the mortality rate is much lower in those cases in which aspiration and amebicides are used than in those treated by open operation. Whenever secondary infection occurs, open drainage of the abscess is necessary. In such cases the prognosis is influenced considerably by the type of drainage and is clearly demonstrated by the results obtained in the authors' cases. In 23 cases in which transpleural drainage was used, the mortality was 30.4 per cent. In 23 cases in which transperitoneal drainage was used, the mortality was 21.7 per cent. In 17 cases in which incision and drainage directly over the abscess was done, the mortality was 17.6 per cent, whereas in 11 cases in which extraserous drainage was done without contamination of an uninvolved serous cavity the mortality rate was only 9 per cent.

Until recently the treatment of amebic hepatic abscess in the United States has been very unsatisfactory. Although Rogers (67), in 1902, demonstrated that the pus in amebic hepatic abscess is sterile, the significance of this finding even today is not sufficiently appreciated by most physicians. Rogers (70) found prior to 1907, in a fourteen-year period before the introduction of ipecac, that in 2,661 reported cases of amebic abscess there was a mortality rate of 56.8 per cent. These patients were all treated by open drainage of the abscess. In contrast to these

figures are the results obtained in a similar series of cases in which ipecac and closed drainage were used. In 111 cases there were 16 deaths, a mortality rate of 14.4 per cent. The open drainage of a non-secondarily infected amebic hepatic abscess is just as illogical as is the open drainage of a sterile tuberculous abscess. This statement is substantiated by the complications which occur subsequent to open drainage. As mentioned, a patient with a non-infected amebic hepatic abscess who does not appear ill and whose laboratory findings indicate a relatively mild infection almost invariably becomes critically ill following the institution of open drainage. If he is able to survive the results of the operation, his convalescence is at best markedly prolonged. In addition to the possibility of his convalescence being prolonged, his chances of recovery are about one-seventh as great as they would be if closed drainage of the abscess had been used. In the 4,760 collected cases in which open drainage was done, the mortality rate was 44.2 per cent, whereas in 457 collected cases in which aspiration of the abscess and amebicides were used, the mortality rate was 6.7 per cent. This relative relationship is also substantiated by the Charity Hospital and Touro Infirmary cases. Whereas the mortality rate in those treated by open operation was 21.6 per cent, that in those treated by aspiration and emetine was only 3.6 per cent. Every case of suspected amebic abscess should be given a course of emetine before any other procedure is used, unless there is apparent danger of rupture of the abscess. Generally, emetine is administered hypodermically in 1 grain (.06 gm.) doses daily for four days before aspiration. Frequently in small abscesses no further therapy will be necessary. The emetine administration should be continued in similar doses after aspiration until a total of from 6 to 10 gr. have been given. According to Leake (43) the amount of emetine administered over any given period of time should not exceed 10 mgm. per kgm. of body weight. An approximate dose for a person weighing 150 lb. would be 10 gr. Emetine should be used cautiously, because, as shown by Rinehart and Anderson (66) working in Leake's laboratory, it produces in the experimental animal serious injury to the cardiac muscle. The lesion found in the heart is quite similar to the Aschoff reaction of acute rheumatic fever. Leake (44) is of the opinion that although other amebicides, actarsone, carbosone, treparsol, chiniofon, and vioform, are safer and more efficient in the treatment of intestinal amebiasis, they should not be used in amebic hepatitis and liver abscess as they themselves are toxic to the liver. The technique of aspiration depends considerably upon the physical findings. In those instances in which there are localizing signs and pointing of the abscess, the aspirating needle should be introduced directly over the mass. In order to prevent secondary contamination of the abscess cavity strict asepsis is essential, which is obtained best in the operating room. Another important reason for performing the aspiration in the operating room is the necessity of immediate open drainage of the abscess in which secondary infection is found. If no localizing signs are present, multiple aspirations may be necessary. In these cases it is imperative that the needle be introduced in such a way that the pleural and peritoneal cavities are not traversed. This can be accomplished by introducing the needle in the tenth intercostal space in the anterior axillary line and directing it upward, medially, and backward. Occasionally an abscess can be entered by inserting the needle below the twelfth rib and introducing it upward and anteriorly. If multiple aspirations are done, it is important to remove the needle entirely before re-introducing it rather than changing the direction of the needle at the original site. In this way extensive injury to the liver will be obviated. Local analgesia is preferable to general anesthesia. Generally a 14-gauge needle is used until pus is obtained. After pus has been obtained it is frequently necessary to introduce a larger needle or even a trocar because difficulty may be encountered in emptying the abscess cavity because of the extreme thickness of the contents. As much of the liquefied necrotic material should be removed as possible in order to minimize absorption of the material. An immediate smear and culture of the pus should be made. If a large number of pyogenic organisms are found in the smear, open drainage of the abscess is necessary, because in such cases the secondary infection is more important than the original sterile amebic abscess. In those cases in which, because of secondary infection, operation becomes necessary, it is imperative that the operative procedure be formed in such a way that an uninvolved serous cavity does not become contaminated. This is best accomplished by draining the abscess extraserously (58, 63). The importance of extraserous drainage of amebic hepatic abscess which is secondarily infected is illustrated by the mortality rate obtained by the various operative procedures in our series. In 23 cases in which a transpleural drainage was done the mortality rate was 30.4 per cent; in 23 cases with transperitoneal drainage it was 21.7 per cent; in 17 cases with incision and drainage directly over the abscess it was 17.6 per

cent; whereas in 11 cases with extraserous drainage it was only 9 per cent.

Involvement of the respiratory tract by amebas is of surgical importance and, with few exceptions, is the result of extension of an amebic process from the liver into the thorax. Several years ago we (59) analyzed 15 cases of pulmonary complications of amebiasis admitted to the Charity Hospital and 153 collected cases. In a series of 2,490 reported amebic hepatic abscesses pleural complications occurred in 198 (7.5 per cent) and pulmonary complications in 209 (8.3 per cent), which gave a combined incidence of pleuropulmonary complications in the reported cases of 15.8 per cent. Of 95 consecutive cases of amebic hepatic abscess admitted to the Charity Hospital and the Touro Infirmary in New Orleans, 15.7 per cent had pleuropulmonary complications. In 7 (7.3 per cent) the hepatic abscess perforated into the lung, in 5 (5.2 per cent) into the pleura, and in 3 (3.1 per cent) there was a bronchopleural fistula. Since this report we (60) have had 6 additional cases making a total of 21 cases, of which 9 perforated into the lung, 5 into a bronchus, and 7 into the pleural cavity. These complications are most likely to occur in the third and fourth decades of life. Only 3.2 per cent of the collected cases were in the second decade, 38 per cent in the third, 25 per cent in the fourth, 23.8 per cent in the fifth, 7.5 per cent in the sixth, and 2.1 per cent in the seventh decade. In our series the majority of patients were approximately two decades older than in the collected series. These complications are more likely to occur in males (96.2 per cent in the collected series). In our original series (59) there were 14 males and 1 female. This is undoubtedly due to the fact that amebic hepatic abscess occurs more frequently in the male. Of our 15 patients 9 were white and 6 were colored. Amebic invasion of the respiratory system is usually the result of extension from amebic hepatic abscesses. Occasionally, however, pulmonary metastatic lesions resulting from invasion of the systemic circulation can occur. It is doubtful whether primary infection of the lung without an antecedent infection of the bowel ever occurs. Panayatalou and Netter (64) described a case which they considered primary amebic bronchitis. Similar cases were recorded by Petzetakis (65), Haberfeld (32), and others (60). Although these cases were considered to be primary in the respiratory tract by the respective authors, it is probable that most if not all pleuropulmonary lesions are the result of perforation of amebic hepatic abscess into the pleural cavity, the lung parenchyma, or into a bronchus.

From an analysis of our own and collected cases we have divided pleuropulmonary amebic infections into five different groups, which are based upon the type of involvement: (1) hematogenous pulmonary abscess without liver involvement, (2) hematogenous pulmonary abscess and independent liver involvement, (3) pulmonary abscess extending from a liver abscess, (4) bronchohepatic fistula with little pulmonary involvement, and (5) empyema extending from a liver abscess. The respective incidences of these types of involvement in the collected series were 14.3 per cent, 10.4 per cent, 37.2 per cent, 19.6 per cent, and 17.6 per cent.

The clinical manifestations of amebic infections of the lung and pleura vary according to the extent and the mode of infection. In those cases in which infection extends from a liver abscess the first manifestation is usually severe pain in the lower portion of the chest on the right side. This is due to involvement of the diaphragmatic pleura by the inflammatory process. A persistent unproductive cough is a prominent symptom. In those cases in which there is a communication with the bronchus, expectoration of large quantities of chocolate-sauce pus occurs. Dyspnea is present in those cases in which there is encroachment upon a considerable portion of the lung field. In the collected series the chief complaints were as follows: cough and expectoration in 64.9 per cent, fever in 17.9 per cent, pain in the chest in 15.6 per cent, pain in the right upper quadrant in 11 per cent, diarrhea in 9.5 per cent, and pain in the shoulder in 2.9 per cent. Aside from the chief complaints, 92.5 per cent of the patients complained of cough and expectoration, 43.2 per cent of fever, 41 per cent of previous diarrhea, 39.7 per cent of an enlarged liver, and 31.3 per cent of chest pain. In our cases in which there was a communication with the bronchus there was a positive history of expectoration of chocolate-sauce pus in every instance. The physical findings vary considerably and are dependent upon the degree and extent of the pulmonary involvement. In the majority of instances the liver is enlarged and tender. As in amebic infections of the liver, the temperature is characteristically not high. In our series the highest temperature was 103. In the majority of cases it ranged between 100 and 101° F. As in amebic hepatic abscess the leucocyte count is only moderately increased, although the increase is greater than in hepatic infections. In the collected cases the highest leucocyte count was 52,000, the lowest 9,700, and the average 18,860. The highest polymorphonuclear leucocyte count was 91 per cent, the lowest 53 per cent, and

the average 72.8 per cent. In our series these respective figures were 51,250, 7,500, and 17,000; and 92 per cent, 70 per cent, and 79 per cent. In cases in which there have been recent perforations into the bronchus, amebas can usually be demonstrated in the sputum. In the collected cases the sputum was positive for amebas in 79.1 per cent.

In those cases in which perforation of an amebic hepatic abscess into the lung has occurred, x-ray findings are characteristic. Prior to perforation the liver abscess produces a localized bulging of the diaphragm. Following perforation a triangular shadow with the base toward the liver and the apex extending toward the hilum can be visualized on the roentgenogram. This is true particularly in lateral roentgenograms, although it is also seen in anteroposterior roentgenograms. In a series of 15 cases a shadow at the right base was found in 12; there was elevation of the diaphragm in 11, abscess of the lung in 3, and abscess with fistula in 2.

As in amebic hepatic abscess, the diagnosis of amebic infections of the pleura and lung is not difficult if the condition is only considered by the clinician. Usually there is a history of involvement of the liver which is evidenced by pain and tenderness beneath the right costal margin. The presence of elevation and fixation of the diaphragm together with evidences of pulmonary manifestations, particularly with the history of expectoration of chocolate-sauce pus, is sufficient to make a diagnosis until proved otherwise. A triangular shadow in the roentgenogram with its base toward the liver and its apex extending toward the hilum is of confirmatory evidence. The finding of amebas in the sputum together with relatively few micro-organisms is conclusive proof of the correct diagnosis. The demonstration of clear zones on the roentgenogram between the pulmonary shadow and the shadow produced by the liver is indicative of a hematogenous abscess. Amebic infections of the lung are likely to be confused with tuberculosis, principally because of the chronicity of the condition and because of the profuse expectoration of bloody sputum. In tuberculosis, however, the greatest amount of involvement is usually at the apex, whereas in amebiasis the lesion is generally at the base and associated with hepatic involvement. The absence of tubercle bacilli in the sputum on repeated examinations will exclude tuberculosis. Amebic infection is likely to be confused with pulmonary abscess, from which it can be differentiated, however, by the absence of severe manifestations, such as marked pyrexia and leucocytosis. The expectoration of relatively large quantities of typical chocolate-sauce pus is of diagnostic importance.

The prognosis in pleuropulmonary amebiasis depends upon a number of factors. The type of pleuropulmonary involvement is important, as the prognosis is gravest in those cases in which a hepatic abscess ruptures into the pleural cavity and best in those cases in which there is direct communication between the hepatic abscess and a large bronchus with a minimum amount of pulmonary reaction. The prognosis is also dependent upon the type of therapy. In the collected cases in which the liver abscess was complicated by a hematogenous lung abscess the mortality rate was 81.2 per cent. In those cases in which the liver abscess was complicated by empyema, the mortality rate was 77.7 per cent. In those cases in which the liver abscess was complicated by extension to the lung the mortality rate was 43.2 per cent; whereas in those cases in which there was a bronchohepatic fistula, the mortality rate was 10 per cent. In a recent analysis (60) of 21 cases admitted to the Charity Hospital and to the Touro Infirmary there was a mortality of 22.2 per cent in 9 cases in which rupture of a hepatic abscess occurred into the lung; in 7 cases in which the hepatic abscess ruptured into the pleura with the development of empyema the mortality rate was 57.1 per cent, whereas in 5 cases in which the hepatic abscess ruptured into a bronchus and evacuated in this way, there were no deaths. The importance of the type of therapy is illustrated by the results obtained with and without the use of emetine. In the collected series the incidence of recoveries without emetine was 43.9 per cent, whereas with emetine it was 91.8 per cent. In our series these respective figures were 40 per cent and 100 per cent. In the cases treated by open drainage without amebicides the mortality rate was 48.2 per cent, whereas in those cases treated by open drainage and emetine the mortality rate dropped to 16.6 per cent, and only 5.4 per cent treated by emetine alone terminated fatally. The total mortality rate in the collected series was 41.1 per cent. In our recent analysis of 21 cases the mortality rate was 28.5 per cent.

The treatment of pleuropulmonary complications consists primarily of the systemic treatment of amebiasis. Emetine is the drug *par excellence*, because the usually employed amebicides exert their action almost wholly if not entirely on the bowel. The value of emetine is illustrated by the recovery incidence of 40 per cent in the authors' cases treated without emetine and of 100 per cent in those receiving emetine. In the cases operated upon in the collected series the mortality rate

was 48.2 per cent without the use of emetine and only 16.6 per cent when emetine was administered. Emetine should be given in the same manner and in the same dosage for pleuropulmonary lesions as for hepatic lesions. Generally ultraconservatism is indicated in the treatment of pleuropulmonary complications, as illustrated by the results obtained in our cases in which there was a 33⅓ per cent recovery incidence after operation and a 100 per cent recovery incidence after conservative treatment with amebicides. In those cases in which there is an amebic hepatic abscess with pleural effusion, evacuation by aspiration is imperative. However, in those cases in which evacuation of the abscess has been secured by a communication with the bronchus, usually anti-amebic therapy is all that is necessary.

Amebic invasion of the cerebrum is a rare complication and according to Craig (14) has never been observed in patients who have not had previous dysenteric manifestations indicating that the original amebic infection is a severe one. The incidence of cerebral amebic abscess apparently is largely dependent on geographic location. Kartulis (40), in Egypt, stated that brain abscess complicated 3 per cent of his cases of amebic dysentery. Of 56 cases collected by Izar (38), 29 occurred in Egyptians.

The entamœba histolytica gains entrance to the cerebrum through the blood stream. Runyan and Herrick (72) reported 2 cases of amebic cerebral abscess, one of which occurred shortly after drainage of a liver abscess and sponging of the cavity with gauze. It is possible that in this manner the organism gained entrance to the vessels as a result of trauma. Undoubtedly a relatively frequent antecedent lesion is a pleuropulmonary amebic involvement. The association of cerebral metastatic lesions with primary pulmonary affections is well known to thoracic surgeons and to pathologists. Suppurative and malignant processes in the lung frequently metastasize to the brain. Huard (37) collected 59 cases of amebic cerebral abscess, all of which terminated fatally. Only 4 were operated upon; in 6 there was rupture of the abscess into the ventricle, which resulted in rapid progression of the symptoms and death within a few hours. Cerebral amebiasis is usually rapidly progressive and, according to Craig (14) and Huard (37), the patients seldom live more than two weeks, death usually occurring in a week or ten days. The symptoms are similar to those produced by pyogenic cerebral abscess, differing only in severity and by marked progression of the amebic abscess. Because cerebral invasion represents an overwhelming infection by entamœba histolytica, the prognosis is extremely grave and, as mentioned above, no patient having this complication has ever survived in spite of the various methods of therapy employed.

Relatively rarely the entamœba histolytica may invade the skin. In practically every instance this has resulted from drainage of an amebic process, either accidental or induced. Following an operation upon an amebic involved bowel, as in the appendiceal-cecal region, amebic invasion of the wound may occur. Drainage of a liver abscess is less frequently complicated by cutaneous involvement. Occasionally cutaneous involvement results from perianal extension of an amebic infection in the distal portion of the rectum. Twenty-eight cases with amebic cutaneous involvement have been collected from the literature (4, 6, 7, 8, 9, 13, 20, 21, 24, 25, 26, 28, 33, 34, 35, 41, 46, 47, 49, 50, 51, 77, 79, 82), of which 11 presented perianal involvement (8, 20, 24, 41, 47, 51, 79, 82). Meleney and Meleney (49) emphasize that it is important to differentiate this progressive gangrene of the skin from postoperative synergistic gangrene which has been so admirably described by Meleney (48). Cutaneous involvement by amebiasis may occur, though rarely, as a primary lesion, as shown by the reports of Engman and Heithaus (25), and Hansen and Stark (33). In these cases there was apparently no evidence of internal amebiasis, but the entamœba histolytica was apparently introduced into the skin from without. Doria (24) describes a case of apparently primary subcutaneous amebic abscess.

The clinical manifestations of amebic cutaneous involvement consists of progressive extension around the site of drainage, which in a period of days or weeks becomes swollen. The edges of the skin become elevated and indurated. There is peripheral pigmentation. Necrosis of the skin with undermining is a prominent factor, and results in progressive cutaneous ulceration, the base of which is covered with adherent dirty grayish necrotic tissue. The discharge is frequently blood-tinged and has a fetid odor. The treatment of cutaneous amebiasis consists of specific therapy in the form of emetine. In those cases in which the anti-amebic therapy does not bring about a prompt subsidence of the symptoms, radical excision of the ulcerating area by means of the high-frequency knife is justified. The resulting defect following excision is covered with skin grafts.

Rarely splenic amebiasis may occur. The condition may be due to metastasis from the intestine or to the direct extension from an amebic hepatic

abscess involving the left lobe. According to Huard (37) only 6 cases of metastatic splenic amebic abscess have been reported. The lesion occurs so infrequently that it is of little clinical significance. Its recognition is extremely difficult, and the diagnosis is usually made after death.

Extremely rarely, amebic infection of the kidney can occur. In most instances this is due, as in the spleen, to direct invasion from the amebic process in the liver. In a few isolated instances apparently the lesion has been metastatic from the bowel and was unassociated with hepatic involvement. Extension of an amebic process from the colon to the bladder with rupture of an abscess may result in the presence of entamœba histolytica in the urine. In 1911 Craig (19) reported a case in which the organism was found in the urine of a patient with a fecal fistula between the site of an amebic ulcer of the intestine and the bladder. Similar cases have been reported by Baelz (2), Fischer (27), and Walton (83). Primary amebiasis of the bladder probably never occurs; the amebic infection is always the result of extension from the intestinal tract to this viscus. Amebiasis may rarely involve the epididymis, the testicle, the fallopian tubes, the prostate, ovaries, vagina, cervix, and penis. Rarely the nasopharynx may be the site of amebiasis.

SUMMARY

1. The ubiquitous occurrence of amebiasis necessitates serious consideration of this condition by surgeons in all parts of the world because it produces with sufficient frequency intestinal manifestations similar to those of other bowel lesions amenable to surgical therapy, and extra-intestinal lesions requiring surgical intervention.

2. Amebic lesions of surgical significance may be classified as follows:

a. Intestinal lesions
   (1). Appendicitis
   (2). Perforation with resulting peritonitis
   (3). Massive hemorrhage
   (4). "Ameboma" (Amebic granuloma)
   (5). Cicatricial stenoses
   (6). Pseudopolyposis

b. Extra-intestinal lesions
   (1). Hepatic abscess
   (2). Pleuropulmonary affections
   (3). Cerebral abscess
   (4). Cutaneous ulceration and abscess
   (5). Splenic abscess
   (6). Genito-urinary affections

3. Amebic appendicitis is one of the most frequent surgical complications of amebiasis and may occur as an acute, suppurative, or chronic inflammatory process. Approximately 10 per cent of patients with symptoms and signs of chronic appendicitis have amebic infection of the appendix which will subside following anti-amebic therapy.

4. Perforation with resulting peritonitis is one of the most serious complications of intestinal amebiasis which usually ends fatally unless localization occurs.

5. Another grave but rare complication is massive intestinal hemorrhage. The treatment which is conservative consists of the administration of amebicides and massive and repeated blood transfusion.

6. "Amebomas" or amebic granuloma occasionally result from repeated amebic invasion of the bowel wall with consequent fibrous-tissue reaction and tumefaction. Occurring most frequently in the cecum and sigmoid, they are of particular interest because they may so easily be confused with tuberculomas, or actinomycotic and, especially, malignant lesions.

7. Localized or diffuse cicatricial stenosis of the large bowel occasionally follows prolonged and recurrent infection and usually necessitates operative therapy.

8. One of the most frequent surgical complications of amebiasis is amebic hepatic abscess, the incidence of which is approximately 5 per cent of all cases of amebiasis. Its pathogenesis, clinical manifestations, and diagnostic features are discussed in detail. The treatment of amebic hepatic abscess consists of the administration of the amebicide *par excellence*, emetine, and aspiration of the abscess contents. In 457 collected cases in which this form of therapy was used the mortality was 6.7 per cent as contrasted to a mortality of 44 per cent in 4,760 collected cases in which open drainage was done. In the authors' series these respective figures were 3.6 per cent and 21.6 per cent.

9. Pleuropulmonary amebiasis is usually a complication of amebic hepatic abscess and occurs in an incidence of approximately 16 per cent. In the absence of secondary infection, therapy is indicated.

10. Less frequent extra-intestinal surgical complications of amebiasis are cerebral abscess, cutaneous ulceration and abscess, splenic abscess, and genito-urinary affections.

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MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Lasher, E. P., Jr., and Glenn, F.: Effects on the Kidney and the Blood Pressure of Artificial Communication between the Renal Artery and Vein. *Arch. Surg.*, 1939, 38: 886.

The authors explain their technique for producing anastomosis between the renal artery and the renal vein, and describe certain of the pathological and physiological effects of this procedure on the kidney. Dogs were used in their experiments.

The kidney distal to an arteriovenous fistula between its vessels rapidly undergoes a series of changes which culminate in entire replacement of the organ by dense fibrous tissue and calcium. A varying amount of parenchymal damage is evident, but tubular changes are always seen. These changes usually consist in granular swelling of the epithelial cells of all parts, with desquamation of many of the cells of the descending limbs of Henle's loops, and of the proximal convoluted tubules. As dissolution of the renal elements progresses the tissues become soft and small granules of gritty material can be felt in the outer cortex. The tubular changes proceed either to necrosis of the structures or to one of various stages of reconstruction and healing. Between the twentieth and thirtieth days the kidney undergoes anemic necrosis which usually involves the entire organ, although a few renal elements about the pelvis and the arcuate vessels, and just beneath the capsule, may survive for a longer time. The organ becomes about half the normal size and is embedded in dense, rather vascular fibrous tissue. Dilated collateral vessels which previously were present are no longer so greatly in evidence.

The authors did not observe any increase in the pulse rate after the formation of one fistula (or of bilateral fistulas) which could be attributed to another and more probable cause. Studies of the volume and cardiac output were not made. Definite evidence of cardiac hypertrophy was not found. The authors state that their failure to note any of the significant clinical or post-mortem signs usually found in the presence of an arteriovenous fistula was due to the small caliber of the openings and the short periods of observation. In dogs between 30 and 45 lb. in weight, the formation of an arteriovenous fistula that is greater in length than 9 mm. diverts a part of the renal blood supply sufficient eventually to inhibit completely the excretory utility of the kidney.

If bilateral fistulas of adequate size are established, or if the normal kidney opposite to that in which a fistula is present is removed, the dog dies in uremia in from four to seven days. However, small amounts of diluted urine may be excreted during the early postoperative period.

Since the construction of small bilateral fistulas does not result in fatal uremia, the authors believe that the chief handicap to renal function in this condition is the lack of circulation of an adequate amount of blood through the organ.

SAMUEL H. KLEIN, M.D.

Hanes, F. M.: Hyperparathyroidism Due to Parathyroid Adenoma, with Death from Parathormone Intoxication. *Am. J. M. Sc.*, 1939, 197: 85.

Hanes reports a death from parathormone intoxication, caused by a parathyroid adenoma.

The patient was a forty-nine-year-old woman who had been admitted to the hospital twice before with pyelitis and lime deposits in both kidneys. The roentgen rays showed already in 1932 a diffuse mottling of the kidneys, which is regarded as a characteristic finding in parathyroidism at the present time. Recently the patient developed pain in her right chest and lost 30 lb.

Her temperature was 38.2° C. There was a 2-cm. nodule at the left lower pole of the thyroid and an indefinite mass in the right hypochondrium. The roentgen rays showed the typical findings of hyperparathyroidism. The blood calcium was 20 mgm. per cent; phosphorus, 4.7 mgm. per cent. The patient, usually cheerful, became depressed and very weak. The calcium rose to 22 mgm. per cent and the phosphorus to 4.8 mgm. per cent; the phosphatase showed 23 Bodansdy units. The temperature rose to 38.5° C. The patient complained of generalized aching, and she suddenly gasped for breath, became cyanotic, and expired.

The autopsy showed a cystic tumor of the left lower parathyroid gland. There were widespread injury necrosis and calcification of the connective tissue, the basement membrane of the parenchymatous organs, the arteries, and the arterioles.

These autopsy findings parallel closely those of dogs killed with parathormone. The cause of death experimentally is circulatory failure; this seemed to have occurred in the patient.

Fever seems to accompany parathyroid poisoning. In this instance it was taken as an evidence of a mild respiratory infection, because of which the surgeon postponed the operation, despite the rising calcium level. It is likely that frequent palpation of the tumor by numerous examiners resulted in expressing more and more parathormone into the circulation. The local necrosis of the tissues due to the hormone probably precedes the calcification. A 20 mgm. per cent level of the blood calcium is very critical, but recovery has been reported after a 23.6 mgm. per cent level had been reached. The high phosphorus level, as pointed out by Fuller Albright, is an added danger signal. Albright advocates a low calcium diet in hyperparathyroidism. FRED S. MODERN, M.D.

Roovers, J. J. C. P. A.: Calcinosis Universalis. *Acta med. Scand.*, 1939, 100: 57.

The author discusses four groups of abnormal calcium deposits in the body:

Calcinosis circumscripta. In cases of calcinosis circumscripta there are present circumscribed, not extensive, calcium deposits in and under the skin. The condition attacks older people, usually involves the arms and fingers, and has a tendency toward localization. The general health is very little affected by these calcifications. The condition in this group of cases is still often being referred to by the name, "calcium-gout"; however, as no metabolic disturbance which runs parallel with the metabolism of uric acid in cases of gout can be demonstrated, it is better to use the descriptive nomenclature.

Calcinosis universalis. Calcinosis universalis, affecting younger individuals, is characterized by extensive calcifications which may be found in various parts of the body. The calcium deposits are so generalized that the patients are often invalids. Muscular atrophy develops, the general condition deteriorates, and the weight diminishes to such a degree that cachexia is the result. Now and then acute exacerbations with new calcium deposits develop, combined with the formation of abscesses in and under the skin, and accompanied by fever. These abscesses may perforate, and fistulas and ulcerations may develop. The prognosis is poor.

Calcium metastases. Under the name "calcium metastases" Virchow described calcifications in cases of decalcification of the bones (osteomyelitis, osteitis fibrosa generalisata, myelogenous leucemia) accompanied by nephritis. These calcium deposits are often explained by skeletal decalcifications, as a result of which the blood is flooded with calcium, whereas the excretion of calcium in the urine is decreased. The calcium is precipitated especially in the tissues which excrete acid: the stomach, kidneys, lungs, and the lung veins, as here the blood contains little carbon dioxide.

Fig. 1. Before treatment.

Fig. 2. After treatment.

Dystrophic calcium deposits. This is the name applied to calcium precipitations which occur in various diseases, e.g., tuberculosis.

The formation of calcium in cases of calcinosis circumscripta and calcinosis universalis may be due to a primary affection. A support for this hypothesis is found in the fact that microscopically the affected tissues often show hyaline degeneration of the impaired tissue in the neighborhood of the calcium agglomerations.

Another hypothesis is a primary disturbance of the calcium metabolism. However, the results of the examination of the blood and basal metabolism do not add support to this explanation.

Improvement of the condition has sometimes been described in the literature, but complete recovery has never been obtained.

A case of calcinosis universalis is reported, in which the patient, a five-year-old girl, was cured by the administration of sodium citrate by mouth, and calcium Sandoz intravenously.

SAMUEL KAHN, M.D.

Daland, E. M., and Holmes, J. A.: Malignant Melanomas. *New England J. Med.*, 1939, 220: 651.

The authors' interest in malignant melanomas has been stimulated by the extreme pessimism expressed toward the disease by many members of the medical profession, since malignant melanomas have been recognized as probably the most highly malignant of all tumors.

The authors have used the term "malignant melanoma," to represent the tumors variously called melanotic sarcomas, melanosarcomas, or melano-

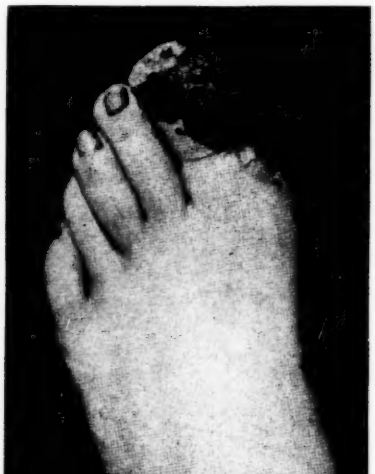

Fig. 1. Malignant melanoma of the great toe.

carcinomas. Masson has shown that these pigmented cells are ectodermal in origin and that they arise from cells of the neural crest. While the lesions are most frequently associated with the skin, they may arise in any part of the body. Cases of primary lesions in practically all structures have been reported.

Records totaling 174 have been reviewed. No marked difference was noted in sex incidence. There were 79 men and 95 women in the authors' series. In the cases of 25 patients, the primary focus was in the uveal tract of the eye. Frequent sites for this condition were the face, neck, and trunk. The incidence of malignant melanomas on the lower extremities is high, and these tumors represent more than half of the malignancies of the skin in this region.

Malignant melanomas arise in congenital pigmented nevi, or as spontaneous primary growths. They rarely arise in pigmented hairy nevi. Trauma to a pre-existing lesion is probably a factor in stimulation of lawless growth. Cauterization or desiccation is dangerous. Metastases may occur through the skin lymphatics, the deep lymphatics, or via the blood stream. While the prognosis is particularly poor in patients with regional lymph-node involvement, an occasional cure may be obtained. Patients should be given the benefit of adequate regional dissection.

The prognosis in malignant melanoma is very poor; however, a few patients can be cured by adequate surgery.

Adequate surgical treatment includes wide local removal and thorough dissection of the regional nodes. The latter procedure, however, is not always feasible. In malignant melanomas of the eye, enucleation is adequate treatment. Roentgen therapy is extremely unsatisfactory, and only rarely is the patient benefited. It should be considered in inoperable cases. Spontaneous regression may occur in the metastases. JOSEPH K. NARAT, M.D.

Poppe, E.: Carcinoma Cutis. *Am. J. Cancer*, 1939, 36: 179.

The histological characteristics of the three types of skin carcinoma are briefly reviewed. One hundred and ninety-eight cases of cutaneous carcinoma (exclusive of carcinomas of the lip, anus, and vulva) were treated during the period from May, 1932, to May, 1935. In 172 instances the tumors were examined histologically.

Of 49 patients with squamous-cell carcinoma, 21 were women whose average age was sixty-nine years, and 28 were men whose average age was sixty-seven years. Twenty-seven of the 49 patients were free from recurrence for more than three years; 10 died from cancer of the skin; and 7 died from intercurrent disease within three years. Three who had shown improvement died from intercurrent disease, and 2 who had suffered a relapse after the first treatment became symptom-free after further treatment.

Of 108 patients with basal-cell carcinoma, 50 were females whose average age was sixty-two and 58 were males whose average age was sixty-five. Seventy-nine of the group were free from recurrence for more than three years; 10, who were symptom-free, died from intercurrent disease within three years; 5 required further treatment. One patient lived, with improvement of the cancerous condition; 3 who showed improvement but were not cured died from intercurrent disease; and 10 died of carcinoma of the skin.

Only 15 tumors of the intermediate type were encountered, and good results were obtained in this group. Thirteen patients were free from recurrence for more than three years; 2 died from intercurrent disease. One of the latter had been cured, and the other had shown improvement in the carcinomatous condition.

Of the total group of 198 patients, 70.2 per cent were free from recurrence for a period of more than three years, and 10.10 per cent of them died of carcinoma of the skin. The fatal cases are reviewed in detail.

In 45 cases the tumor was situated in the eyelids or in the immediate vicinity of the eye. In 13 of the 45 cases permanent injuries followed; in these the possible effect of irradiation could not be ruled out. Such changes resulted in only 1 case in which the implantation of radium needles was the only form of treatment employed. A radium moulage was used alone in 16 patients, 3 of whom exhibited age injuries. Teleradium treatment alone, or in conjunction with other methods, was used in 14, and in 8, injuries to the eye occurred. One patient

was treated with roentgen therapy in combination with radium implantation. Two patients were treated by electrocoagulation.

The author concludes that irradiation, particularly with radium, probably produces better permanent results than surgical treatment, and the cosmetic result is, as a rule, more satisfactory.

HAROLD C. OCHSNER M.D.

DUCTLESS GLANDS

Aschheim, S., Portes, L., and Mayer, M.: The Gonadotropic Hormones. A Critical Study with Regard to Their Rôle in the Physiology and Pathology of the Ovarian Functions (Les hormones gonadotropes. Étude critique de quelques points relatifs à leur rôle dans la physiologie et la pathologie des fonctions de l'ovaire). *Ann. d'endocrinol.*, 1939, 1: 42.

Knowledge concerning the rôle of the anterior lobe of the hypophysis and its relations to the genital functions has been greatly extended by experimental studies during the past fifteen years. It was found that hypophysectomy caused arrest of the sexual development in young animals and marked regression of the ovaries in adult animals; while injections of the extract from the anterior lobe stimulated the genital growth of the young organism and had a selective action on the suprarenal glands and especially on the ovaries. The ovaries underwent considerable hypertrophy with formation of numerous corpora lutea, but without the production of premature artificial puberty. Later, Zondek and Aschheim obtained all the characteristic aspects of maturity by the implantation of small pieces of the anterior lobe in immature animals, this experiment showing that the maturation of the ovaries depends on the action of a substance produced by the anterior lobe, the gonadotropic hormone. The changes caused by this hormone in the primary follicles are so clear-cut and specific as to constitute a test of the presence and activity of the hormone, and the different aspects of the ovarian effect are represented by Reaction I (the formation of enlarged follicles accompanied by keratinization of the cells of the vaginal mucosa), Reaction II (the formation of hemorrhagic follicles), and Reaction III (the formation of corpora lutea).

The experimental studies of Aschheim on pregnant women revealed the presence of gonadotropic substances, similar to those of the hypophysis, in the placenta, chorion, amniotic fluid, embryo, decidua, corpus luteum and its vicinity, blood, and urine. The hypothesis of hyperproduction of gonadotropic hormones by the hypophysis of pregnant women was consequently abandoned, and the analogy of the effects obtained by the implantation of the anterior lobe and by the injection of placental extract led to the acceptance of the two substances as being biologically identical, and to the designation of the gonadotropic substance, which characterizes pregnancy, as prolan. Then arose the problem whether the hypophyseal hormone and prolan are one substance, or two substances similar in their effects but of a different nature. A still more complex problem was the determination whether the different effects I and III are the result of a quantitative variation or of a diversity in the nature of several principles which, respectively, produce the increase which occurs in the volume of the follicles and their luteinization.

It was soon evident that complete identity did not exist between the hypophyseal gonadotropic hormones and prolan, the effect of the former on the ovaries being much stronger than that of the latter. Prolan has only luteinizing properties in hypophysectomized animals and, in order to explain its action on the follicles of immature animals, it was accepted that it exerts a direct effect on the hypophysis and, through this intermediary, stimulates the growth of the follicles. Other differences between the two substances are that prolan causes the production of estrogenic hormone and that the hypophyseal gonadotropic hormone stimulates the testicles and ovaries of birds. The difference between the two hormones is also confirmed by the analysis of the biological reactions of pregnancy.

The studies of various authors have led to the conclusion that the hypophyseal gonadotropic hormones contain at least two factors: Factor A, which causes enlargement of the follicles and subsequent estrus in immature animals, and Factor B, which causes ovulation and luteinization of the follicles. Aschheim succeeded in producing a complete genital cycle in immature animals by the successive use of the urine of castrated women containing Factor A and of the hypophyseal extract containing Factor B. The results of his experiments were confirmed by various other authors. Undoubtedly, the gonadotropic hormones are very complex substances which contain several principles or which may occur in several states that exercise similar or antagonistic actions.

The rôle of the gonadotropic hormones in the mechanism of the sexual functions may be conceived as follows:

1. Before puberty the anterior lobe of the hypophysis contains and secretes the hormone in small amounts, but the receptor organs are apparently not affected by it.

2. During the sexual period the hypophysis secretes enough Factor A to cause complete ripening of the follicles and insure the production of estrogenic hormone. This causes estrus in the genital organs and acts on the hypophysis to inhibit the production of Factor A and stimulate that of Factor B; the luteinizing factor then acts on the ripened follicles, insures ovulation and luteinization, and stimulates the production of progesterone. The menstrual flow decreases the amount of estrogenic hormone present in the blood; the inhibition of the hypophysis stops, and the secretion of Factor A recommences, again starting the cycle.

RICHARD KEMEL, M.D.

Hamilton, J. B., and Dorfman, R. I.: Influence of the Vehicle upon the Length and Strength of the Action of Male Hormone Substance, Testosterone Propionate. *Endocrinology*, 1939, 24: 711.

Comparison has been made of the action of testosterone propionate when injected in crystalline form and when dissolved in various solvents. This action was determined in terms of comb growth of day-old chicks following a single injection of the androgen. The following conclusions were drawn:

Crystals gave the strongest and longest stimulation, a single injection of 20 mgm. lasting for seventy-one days. Beef tallow was next best, a 20 mgm. dose exerting an action like that of crystals for seventeen days and continuing to stimulate for twenty-seven days. Palmitic acid was also a satisfactory vehicle. Peanut oil, an example of the oils which have been used routinely in clinical therapy, acted in a less pronounced manner over a total of seventeen days. Spermaceti wax and mineral oil gave less effects. Precipitation of the hormone from a solution injected intramuscularly resulted in less comb growth than that obtained when the hormone was dissolved in peanut oil. Twenty mgm. of testosterone propionate produced a greater duration and maximum of comb growth than 5 mgm., but the general response to different solvents was the same with both doses.

Pellets of crystalline hormone offer a means of administration which may be perhaps less expensive and more convenient and practicable clinically than the present intramuscular injection of oil solutions. With implantation methods, the correct doses and the feasibility of the treatment in human beings have yet to be determined. There are definite dangers in forms of administration that provide vigorous androgenic stimulation of long duration.

SAMUEL KAHN, M.D.

Turner, H. H.: The Clinical Use of Synthetic Male Sex Hormone. *Endocrinology*, 1939, 24: 763.

The author reports observations based on a group of 54 males ranging in age from seven to seventy-five years, and showing various forms of genital hypoplasia and malfunctions of the sex organs. Pertinent data are presented concerning 15 selected cases typical of the group; 11 showed hypogenitalism, 2 complained of impotency and symptoms of sexual decline, 1 had well developed symptoms of prostatic hypertrophy, and 1 well advanced gynecomastia. All were treated with testosterone propionate, the synthetic male hormone.

In doses of from 10 to 75 mgm. weekly, it was found effective in all of the cases of hypogonadism, as evidenced by the promotion of penile and hair growth, the production of erections and emissions, the development of the libido and potentia coeundi, and by generalized changes in the secondary sex characteristics. Gynecomastia with normal secondary sex development was apparently not influenced by the hormone. Subjective symptoms of sexual diminution associated with senescence were considerably relieved, as were the usual symptoms and signs of obstruction in cases of prostatic hypertrophy. While no undesirable effects were noted in any case it is advised that untoward effects be carefully sought for and beneficial action evaluated critically. Decision as to the continuance of treatment should be guided by the results.

WALTER H. NADLER, M.D.